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ELECTRICAL WORLD

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GENERATION SPACE FACTOR TRIPLED

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PHILIP SPORN . . . G. G. LANGDON
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THE MEASURE OF A SELLING JOB

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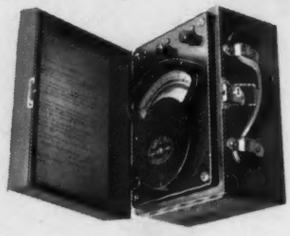

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LETTERS TO THE EDITOR

McNinch on "Rural Electrification"

To the Editor of ELECTRICAL WORLD:

Our attention has just been directed to the so-called "Rural Electrification Balance Sheet," appearing in the ELECTRICAL WORLD of June 22, 1935.

It is stated in the heading appearing beneath the title that it is "Based on data given in memo by J. P. Schoenzer (*sic*), National Power Survey, bearing names of Basil Manly, commissioner in charge; Thomas R. Tate, director; Frank R. McNinch, chairman Federal Power Commission."

This statement purports to show for all the farms which are not now receiving electric service the cost of installing service facilities, cost of utilization equipment, utility income from farms, farmers' annual costs and total annual charges to serve all unserved farms.

Thorough investigation reveals that no memorandum has ever been prepared by Mr. Schaenzer or any one else connected with the Federal Power Commission covering the cost of serving all unserved farms in the United States or any of the other items mentioned above. No calculations even of this character have been made by any one connected with the National Power Survey or the Federal Power Commission.

The only excuse that can be offered for referring to the Federal Power Commission in connection with this grossly inaccurate and misleading statement is the fact that certain figures relating to the number of farms receiving electric service and the average usage per farm might have been taken from a memorandum bearing Mr. Schaenzer's name, which was issued under date of March 26, 1935. Since these were Census figures, as was clearly stated in the memorandum, there is no excuse even for this reference.

With the exception of the figures relating to the number of farms and average usage, every other figure in this elaborate statement is either a bald assumption or is derived from some source other than the commission's memorandum. And yet ELECTRICAL WORLD has the effrontery to suggest by its heading that the Federal Power Commission is responsible for all figures in the statement!

The figures assumed in the calculations are for the most part absurd and, being attributed to the commission by implication, are obviously intended to create the impression that the commission and its staff are ignorant of the facts and accustomed to making wild assumptions.

Whatever may be the differences between the views of the Federal Power Commission and the ELECTRICAL WORLD on questions affecting public utilities and holding companies, there can be no excuse for the publication of such a clumsy fabrication attributing to a governmental agency false and misleading statements for which it is in no sense responsible.

Your retraction and apology are requested.

FRANK R. MCNINCH,
Chairman,
Federal Power Commission.

Rural Electrification Estimates Clarified

To the Editor of ELECTRICAL WORLD:

On page 30 of the June 22, 1935, issue of the ELECTRICAL WORLD appears a table, "A Rural Electrification Balance Sheet—Based on data given in memo by J. P. Schaenzer, National Power Survey; bearing names of Basil Manly, Commissioner in Charge; Thomas R. Tate, Director; Frank R. McNinch, Chairman Federal Power Commission."

Only a few of the items and figures used in the "Balance Sheet" were identical with those contained in a press release of March 26, 1935, prepared by the writer. The rest had no connection whatever with any statement that has ever been issued under my name. The only items that could have been taken from my memorandum were:

1. Your item "A." Number of Farms in the United States, 6,288,648. Source, United States Census of Agriculture, 1930.
2. Your item "B." Farms served by central electric stations, 743,954. Source, Edison Electric Institute, 1934.
3. Your item "C." Approximate number of farms having individual electric lighting plants, 250,000. Source, United States Census of Agriculture, 1930.
4. Your item "F." Customers per mile, 3.6. The only figure corresponding to this applies to 17,332 selected rural customers in 43 counties in various states, and not to the United States as a whole. Source, United States Department of Agriculture, 1934.

The data for the only other item which corresponds with the memo was secured from the Census of Electrical Industries, 1932, and was so stated. It applies to your item "P," and is as follows:

5. Average energy consumption per farm per year for the West South Central, Mountain and Pacific Coast States, 7,313 kw.-hr.
6. Average annual bill for the above group, $127.
7. Average energy consumption per farm per year for the remaining states, 760 kw.-hr.
8. Average annual bill for the above group, $50.

In addition to the above, your "Balance Sheet" contains many items, figures and statements pertaining to such subjects as cost of rural lines and service, investment by farmers in wiring, electric household equipment and farm equipment, and fixed charges dependent upon amortization, interest, depreciation, taxes, insurance, and other details. As none of this information was included in the press release, it is assumed that you must have secured it from some other source.

J. P. SCHAENZER,
Agricultural and Irrigation Engineer,
National Power Survey,
Washington, D. C.

[The letters of Mr. Schaenzer and Mr. McNinch are self-explanatory. This table and these data were discussed in ELECTRICAL WORLD for July 6, page 84. The unit data used in the compilation of the Rural Electrification Balance sheet were taken very largely from the report of Mr. Schaenzer, as he indicates, and included his use of data from the Census and other sources. The totals were derived by us from these figures, together with the use of other representative unit data. The totals show the order of magnitude and the economic difficulties of any project to electrify all unserved farms. There was no intent to credit this table to the Federal Power Commission except to credit Mr. Schaenzer with a splendid report, or to use it as other than a constructive contribution to the rural electrification studies in which the industry is sympathetically engaged. The data represent totals derived from unit figures obtained from and used in installed rural projects and are valid to this extent.—EDITORS.]

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What Are Average Load Factors?

To the Editor of ELECTRICAL WORLD:

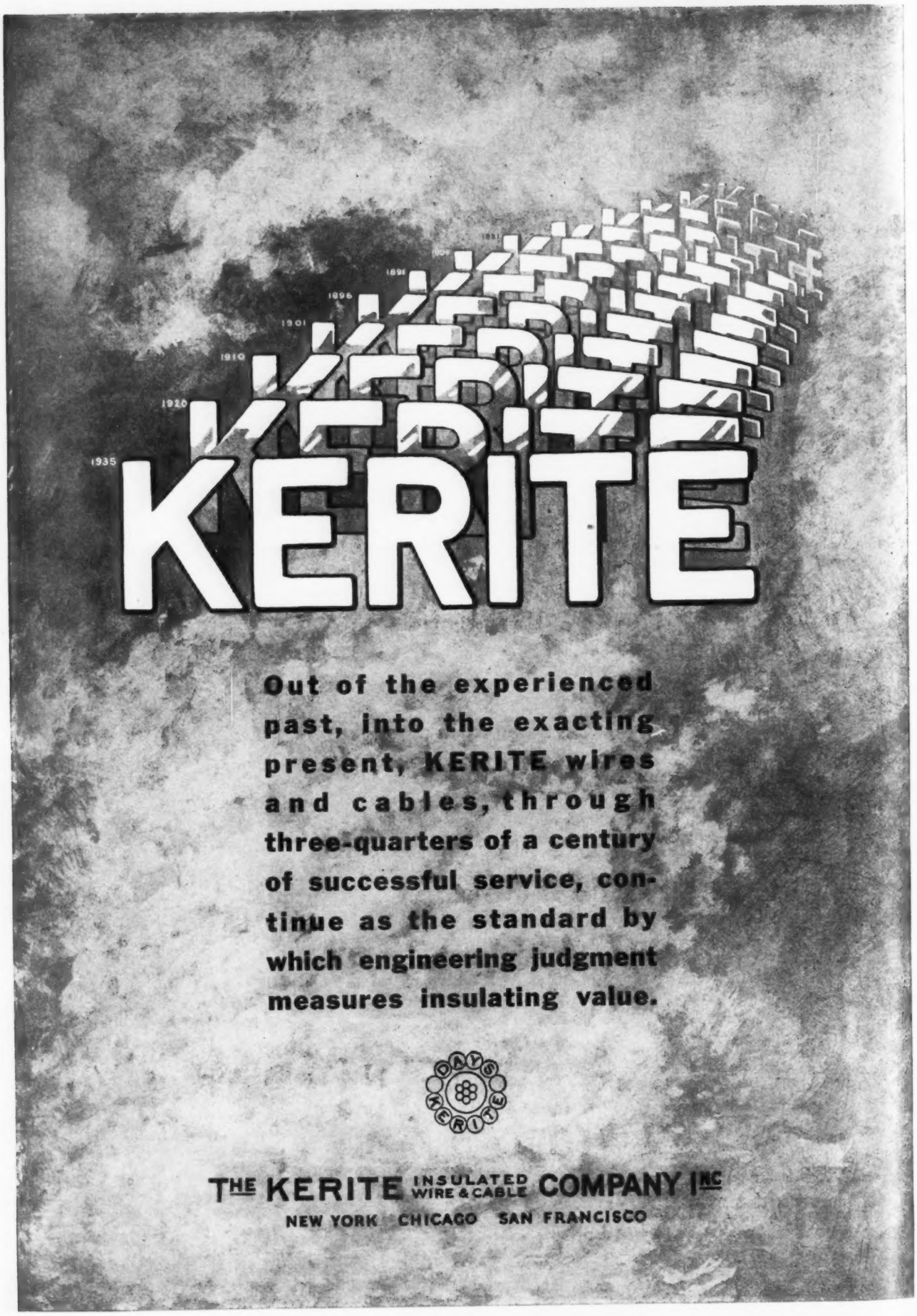
I have been searching for the past week in back numbers of the ELECTRICAL WORLD and other similar publications for a good average figure on load factor for various classes of electrical usage, such as residential, commercial, industrial, etc. I would greatly appreciate it if you could refer me to any source of information along this line. By load factor, I mean: Kw.-Hr. used per year

Maximum Kw. demand $\times$ 8,760

taken for a fairly large group of customers [in each class].

CLARENCE J. BELLER,
Cleveland Heights, Ohio.

[Data were given in the ELECTRICAL WORLD of April 2, 1927, page 704; March 10, 1928, page 515; May 25, 1929, page 1033; January 10, 1931, page 92. Readers are invited to contribute additional information.—EDITOR.]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MANAGEMENT • ENGINEERING • OPERATION • UTILIZATION

PUBLISHED EVERY OTHER SATURDAY

AUGUST 3, 1935

More Business and More Profits

MANY people predict a business boom for this country in the coming months. They say it is inevitable. At all events, business is increasing rapidly and the electrical industry is leading the advance. Pessimists about the future of the electrical industry will do well to turn their attention from Washington to the realities of the business. The facts show that the industry is having an encouraging increase in sales with a corresponding increase in gross and net earnings. It is on the verge of prosperity equal to that of the past.

Energy sales of utilities exceed boom-day values for the corresponding period. Gross and net earnings of utilities, manufacturers, wholesalers and retailers are generally above the values for last year and are increasing. All quotas for business volume by individual enterprises are being exceeded. Electric service and electric products are in demand.

THESE conditions are true in nearly all lines of business. Steel, automotive, machine tool, construction and other industries are at high levels and increasing. Business councilors tell their clients to look for a steady increase in business for some months. Wall Street expects a long-term bull stock market. Banks and investors are buying securities and loaning money. Government spending is starting at an unprecedented rate to add impetus to the buying movement. These facts spell opportunity to the electrical industry.

But what about money and credit? Conditions were never better. Already utilities have refunded some $450,000,000 of bonds at the lowest rate of interest known in recent years. Banks and security houses are swamped with negotiations for more refunding. It looks like a $600,000,000 to $800,000,000 bond year with a coming pick-up in investor demand for equity securities. Utility credit is second only to government credit. Bond prices are back to 1929 levels, stock prices are steadily increasing. Hard-boiled owners of dollars by their acts show that they believe utilities afford the best investment of this period. These facts reflect business judgment, not the political fogs of Washington. Electrical manufacturers likewise have good earnings and good credit.

WE BELIEVE the electrical industry itself does not have adequate knowledge of the business outlook and of its opportunities for expansion. Exceeded quotas are looked upon as accidents and not as positive indicators. Executive attention, money and man-power are being used too casually. The industry is relaxed and rather content with the *status quo*, because red has turned to black on the books. It is not aggressive in its endeavors to expand sales, service and facilities. This is quite natural. The upturn in business has occurred rapidly. There have been four difficult years of hard times. The weather and the season are not conducive to action. Permanent business expansion may not be here. Any of many factors may explain the bad psychological condition of the industry.

But this attitude is not good business. It does not conform to past records of the industry. Capital and consumer goods are on the move and there is competition for the new business between industries. However popular electric service and electric products, they must be sold. The prosperity of the electrical industry now, as always, lies in the hands of its own executives. An opportunity beckons. The time for commercial action is right now.

And to the efforts of each electrical enterprise should be added joint action by all enterprises and all branches of the industry. Joint bureaus and committees for sales promotion should be formed for each market. Individual branches are well organized. Here is a business outlet for their energies that means profits for the industry. N.E.M.A. is in position to bring the initiative and leadership into action to awaken the industry to its opportunity and to help organize it for effective work. Why not act together for a common objective—more business and more profits?

·TRENDS·

Congress—Tired but Responsible

AFTER the flash of indignation at the NRA decision the Administration let loose a host of punitive measures that an exhausted Congress received with dismay and acts upon reluctantly. Essentially the Administration wants three things: (1) Redistribute incomes, soak-the-rich; (2) straitjacket business through federal control to prevent big business to exist—bigness is bad; (3) rewrite the Constitution to give federal control of all our activities. Bills to embody these suggestons or to create the political background to carry them out are numerous. All are part of a pattern. We do not believe in discussing these matters from the point of view of partisan politics, but we do believe in constitutional government and private initiative instead of bureaucracy to run business. The genesis of these bills is a new deal philosophy that is not suited to this country and a petulant reaction to the restraints wisely set up in our Constitution. Pity the poor Congressmen, but it is their duty to think straight and act honestly even under trying political and weather conditions. The mass of the public doesn't know what it's all about and as yet doesn't much care. The Congress has the power and the responsibility to act. The reckoning with the public will come later.

Jobs, Not Profits

COMMENTATORS on the theory of Mr. Tompkins that the new dealers covet the utilities to make money is that they are not that ambitious. Several say that the real basis for the attack is to get jobs for many good political workers and to build up a patronage outlet of great magnitude. They doubt that bureaucracy thinks it could run the business for any length of time and even pay operating expenses. We agree that this comment is logical and in accord with past experience with government operation of business. By the way, the second article by Mr. Tompkins, in this issue, rings the bell. It is well written and right to the point. We look forward eagerly to more equally good articles by Mr. Tompkins dealing with other aspects of the utility situation.

Forthright McCarter

MR. McCARTER'S statement of the money that has been spent by E.E.I. for legal expenses to defend the industry against political persecution is frank, fearless and refreshing. Self-defense is an inherent right and needs no secrecy. The mere statement of lawyers retained and moneys paid out to further court action to prove whether the government program is constitutional or not sets it all in the sunlight as natural and proper. And since final judgment will come at the bar of public opinion, frankness is the best defense.

Co-ordinate Breaker, Relay and Fuse

IN THE widespread modernization of oil breakers the relay and the fuse should not be forgotten. Major improvements have been made in these devices and, in addition, when a change in speed and capacity is made by modernizing an oil breaker care must be taken to co-ordinate the fuse and relay with the breaker. From an operating standpoint there is much to be done on each system to get these devices tuned together for best operation and maximum economy. Several properties are investigating this aspect of the business and find worth-while results.

No Time to Take Chances

A RETURN of load revives the question of safety. Utilities and industrials cannot afford to take chances on accidents at this time. They are on the spot and bad public and labor reactions follow accidents. There are two reasons for accidents. One is lack of care and training in operation. This is apt to be prevalent as a consequence of the let-down during the depression. The cure is a revival of interest in safety and strengthened safety organizations. The second cause is the use of inadequate or obsolete equipment. There is much of this in use. It served when loads were down, but it will not serve at rated or over loads with safety. Nor can chances be taken with inadequate reserves and duplications under conditions that now exist. Every property and every industrial plant should turn its attention to safety. A survey, a trained personnel, a check of equipment—this is the start.

Use Modern Machines

THERE is only one road to increased employment, raised standards of living, more business volume and greater profits. It is the use of more efficient and labor-saving machinery. This is the only way to increase production. It is the only way to lower prices without disturbing wages. To do this against the opposition of new school reformers and false economists requires the hard-boiled courage and initiation of private enterprise that has already raised the mass of our population out of the subsistence standards of the old agricultural era. The torchbearer on this road should be the electrical industry.

Tubes for Power

ELECTRONIC tubes for use by utilities and industrial plants are advancing rapidly. We have been publishing a series telling of the new uses of tubes on the American Gas & Electric system. Excitation for machines, communication, battery charging, relaying and many other functional operations are speeded up and made more precise by the use of tubes. The same conditions prevail in industrial plants. A commentary on this situation is the remark made by a competent man: "There are only about six men in this country who know power and also electronics and they are so busy they cannot keep up with the demand." This indicates that electrical engineers have an opportunity in a new field that is now just in the pioneer

The Editors Use a Spotlight on Current Happenings

stage. Incidentally, manufacturers will do well to look at tube applications to power and industry as a source of new business that can be had through development and research.

Get Ready for Industrial Production

INDUSTRIAL engineers and power salesmen now have an opportunity to modernize industrial plants. Business and earnings are on the up-grade. All plants should be checked over for the economy of the best control, drive, measurement, power factor and lighting. Economic application of electric heat should be found and recommended. A definite program of plant analysis on an individual and co-operative basis in each area will develop a large number of modernization jobs. And all of these will not take large capital expenditures. Many of them will involve items such as fuses, meters, drives and control that will bring major savings for minimum expenditures. Fall production lies ahead, and now is the time to do this work.

Cassandra in Truth

OUT in Los Angeles E. H. Foley of P.W.A. called the bills drafted for the states useful and valuable and called us a modern Cassandra for condemning them. Mr. Foley's analogy is unfortunate. The prophecies of Cassandra were fulfilled, but Apollo decreed that they should never find belief. Perhaps Mr. Foley is the modern Apollo.

Look at the Balance Sheets

AN ENCOURAGING note is shown by the statements of six months' operations by electrical manufacturers. Sales and billings are up 15 to 50 per cent over the corresponding period last year. Net profits are quite stimulating. Capital goods are on the up-grade and the electrical industry is reaping rewards. It can still further prosper by more active sales efforts to take advantage of the new plateau of business.

A Turn of the Tide

LOOK at the kilowatt-hour output of the utilities! If this keeps up, and it will, the winter peak will exceed 1929 values by 100,000,000 kw.-hr. And this is August. These energy data afford the best possible gage for national business. They precede billings. They show power is being used to make goods that will be sold. There is a new atmosphere and a new vigor in this country. The electrical industry will do well to serve the demands that will come on it shortly. This is no time for golf, feet on the desk or pessimistic predictions. Again we say, look at the kilowatt-hours.

Our Boulder Dam Issue

IN OUR next issue we have a series of special articles on the Boulder power project. This is the largest power undertaking yet recorded and it embodies the largest and latest developments in engineering and apparatus. The generators, the transformers, the breakers, the line, the control and the protection are the last word in magnitude and departure from traditional design. Readers may question the economic aspects of this undertaking and take issue with its authorization, but they will be interested in the engineering features. The manufacturers and engineers have made an advance in the art of major importance to the industry.

Air-Power for the Crimea

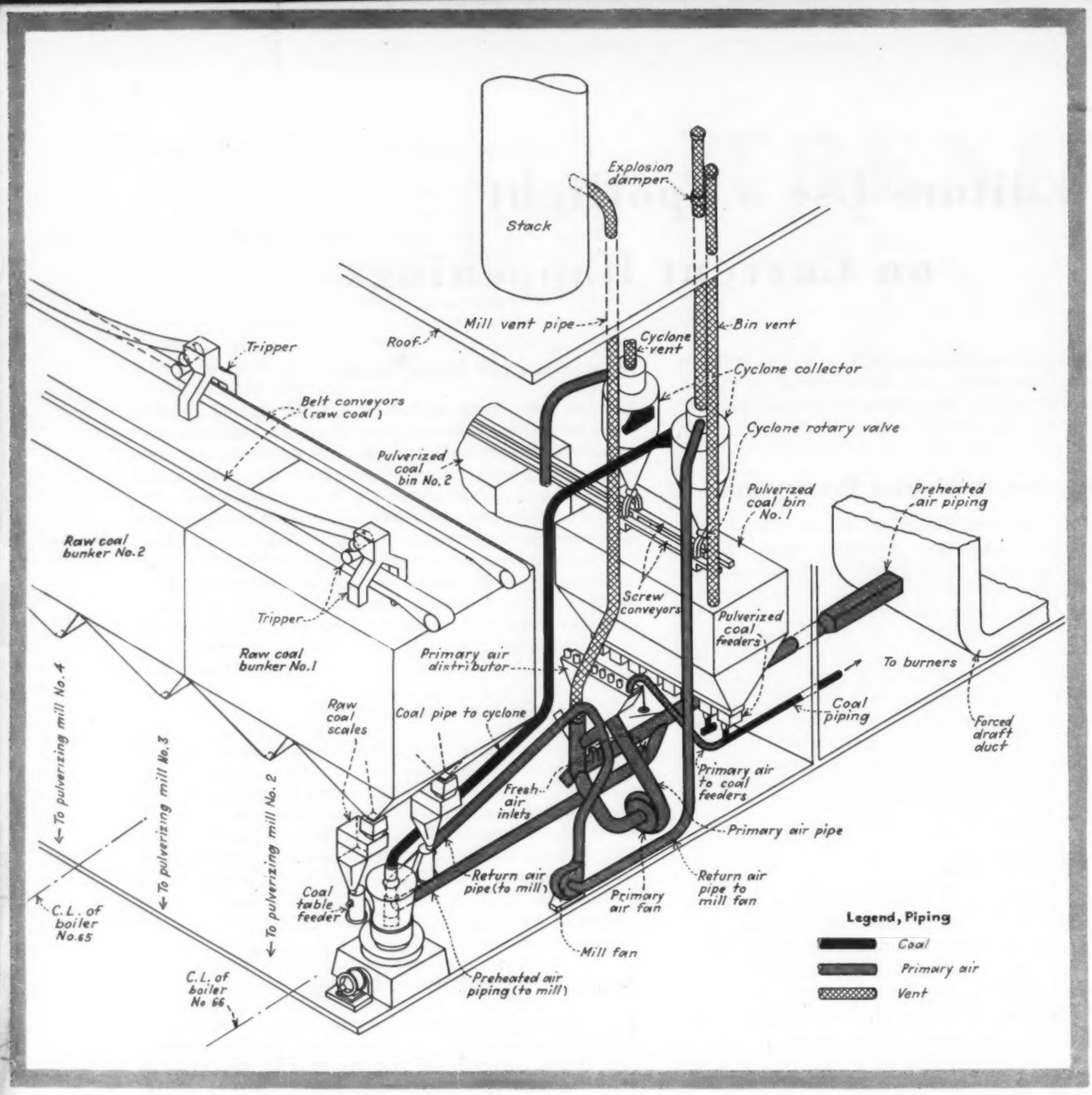
GOOD results having been obtained with a 100-kw. wind-driven generator at Balaklava (Crimea), a 10,000-kw. station is now to be erected high in the mountain range. According to the London *Electrician* (July 12, 1935) there will be two 5,000-kw. units in the station. The tower will be nearly 500 ft. high and of reinforced concrete. Operation will be in conjunction with nearby water power. The ultimate project now contemplated for the plateau of the Crimean peninsula is 200,000 kw.

More Generation in Offing

LOADS are now increasing and this means more generating capacity. The 160,000-kva. unit for Philadelphia Electric and the 5,000-kva. used for Iowa Electric Light & Power mentioned in current issues are indicators of the trend. The vacation in power stations is about over. The question mark is how long will business continue to increase? We think it is good for at least nine months at an accelerated rate and the safe plan is to measure generating capacity needs on this basis.

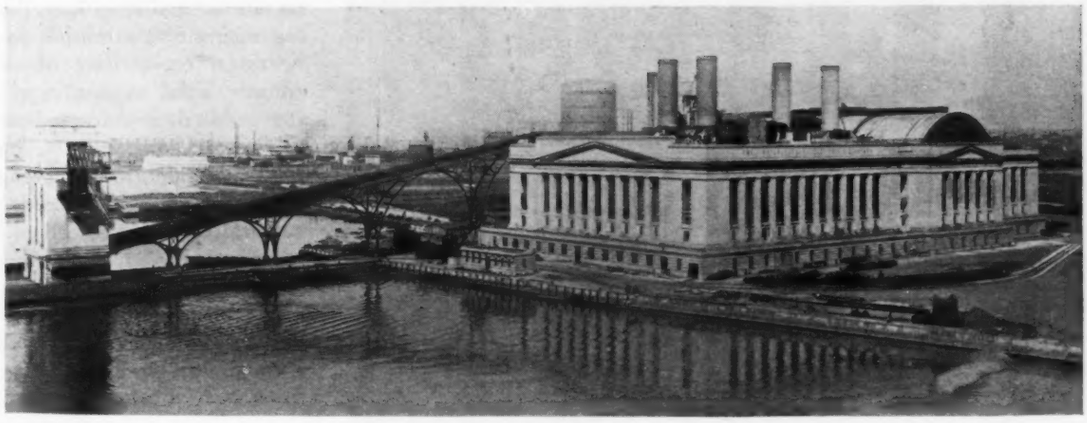
Term Payments on Appliances

A LARGE part of major appliance sales is based upon small down payments and long terms. It is estimated that at least $10,000,000 is outstanding at this time. This approach to the market sells the products, but raises some important business questions. The length of term payment has been extended gradually until even four years is not uncommon. What should the term be for each major appliance? Life experience would be a good guide and may now be had on some appliances, but the variation in design, in local conditions and in service severity makes it difficult to fix this life definitely for national sales. In theory, at least, the term payment should be well on the safe side of the useful term of service life. Some data and experience on this question would be of value to the industry at this time.



FUEL PULVERIZED FOR NEWEST BOILER UNIT

Each of the two new 600,000 pounds per hour Babcock & Wilcox boilers serving the new 165,000-kw. turbo-alternator in the Philadelphia Electric station has two mills, two exhausters, two feeder blowers, eight pulverized coal burners and one storage bin for pulverized fuel. Fireproof masonry isolates this equipment from the boiler room.



Richmond Station Triples Generation Space Factor

Outstanding Example of Utilization of Existing Investment in Conjunction With Modern Possibilities in Designed Economies

By R. W. WILBRAHAM . . . RAYMOND BAILEY

Chief Electrical Engineer
United Engineers & Constructors

Assistant Electrical Engineer
Philadelphia Electric Company

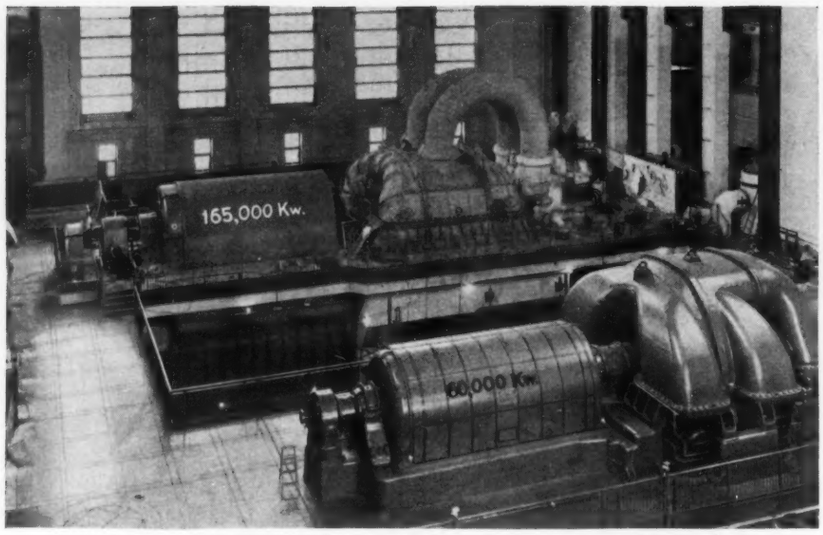
THE Philadelphia Electric Company has recently placed in service in the Richmond generating station a 165,000-kw. turbo-generator with two pulverized fuel-fired boilers of 600,000 lb. per hour capacity each, which will increase the total capacity of the station to 285,000 kw. Utilization of boilers provided for generators previously installed permit operating the 165,000-kw. unit at full capacity, but at an increased heat rate. The load served from this station is varied, including 13.2-kv. lines to urban substations; 13.2-kv., 60-cycle commercial customers; single-phase, 25-cycle supply, through frequency converters, for the Pennsylvania Railroad electrification, and supply through step-up transformers to the 66-kv. transmission system.

In the initial development at Richmond two 50,000-kw. turbo-generators, later rerated to 60,000 kw., the largest single-shaft, 1,800-r.p.m. machines available at that time (1925) were installed in a building constructed to accommodate two additional similar machines with necessary boilers. It was expected that the third and fourth machines would be installed two to four years later. However, the construction of the Conowingo hydro-electric plant and the acquisition of the Deepwater plant deferred the need for additional capacity at Richmond.

There were a number of factors that influenced the decision to install a new generating unit at Richmond rather than at some other part of the system. Relatively large increase in load at Richmond was expected, particularly with the contemplated ultimate installation of 120,000 kw. of frequency converter capacity to supply energy to the Pennsylvania Railroad electrification. There was also the advantage of available building space, existing coal-handling facilities, etc., and also a tie-in of considerable capacity with the transmission system. A unit of 165,000-kw. capacity was selected, as this was the largest that could be intalled in the existing building.

The outstanding development in the design of turbo-generators is exemplified in the placing of a 165,000-kw. machine and its auxiliaries in the section of the building originally intended for one of 50,000-kw. capacity. Many new and interesting problems have arisen out of the complications involved in fitting a unit of this size into the space designed for a machine of less than one-third its capacity. The research into a new field of bus design, the inductive heating of structural members and conduit systems and the extensive tests conducted to determine remedial measures for this heating have been described in a paper presented before the 1934 summer convention of the A.I.E.E.*

*A 7,000-amp. bus, H L. Unland, W. B. Morton, V. R. Bacon, *A.I.E.E. Transactions*, June, 1934



Little more floor space for unit of nearly three times the capacity

Among the factors leading to the decision to provide additional capacity at the present time are the following: Savings on account of purchasing equipment and material at the present low-price levels, and the gain through the use, to a relatively great extent, of the more highly skilled labor available during the period of depression. There is also the advantage of the operating economy to be gained with the use of the more efficient unit.

Approximately $6,000,000 was expended locally for material and labor, of which about $2,500,000 represents direct labor payroll. This would have the effect of stimulating confidence and assist in bringing about recovery, particularly in the Philadelphia area.

Turbine, Condenser and Circulating System—The turbine is a Westinghouse tandem-compound unit operating with steam at 400-lb. pressure and 850 deg. F. with four-stage bleeding. The high-pressure cylinder is a single-flow, straight-reaction type and the low-pressure cylinder is a double-flow unit. A 1.3-r.p.m. spindle-turning gear assists in the distribution of heat throughout the turbine rotor in starting the unit and maintains alignment which enables the unit to come to speed in 60 minutes and ready to carry 20 per cent load in 70 minutes. Two 20-in. boiler leads are connected to a 30-in. stub header, from which two 24-in. lines feed the turbine. Joints in these lines were electric fusion welded and flanges were used only at the turbine connection. To reduce the stresses set up by welding, electric stress relievers were designed and constructed on the job and applied with very satisfactory results.

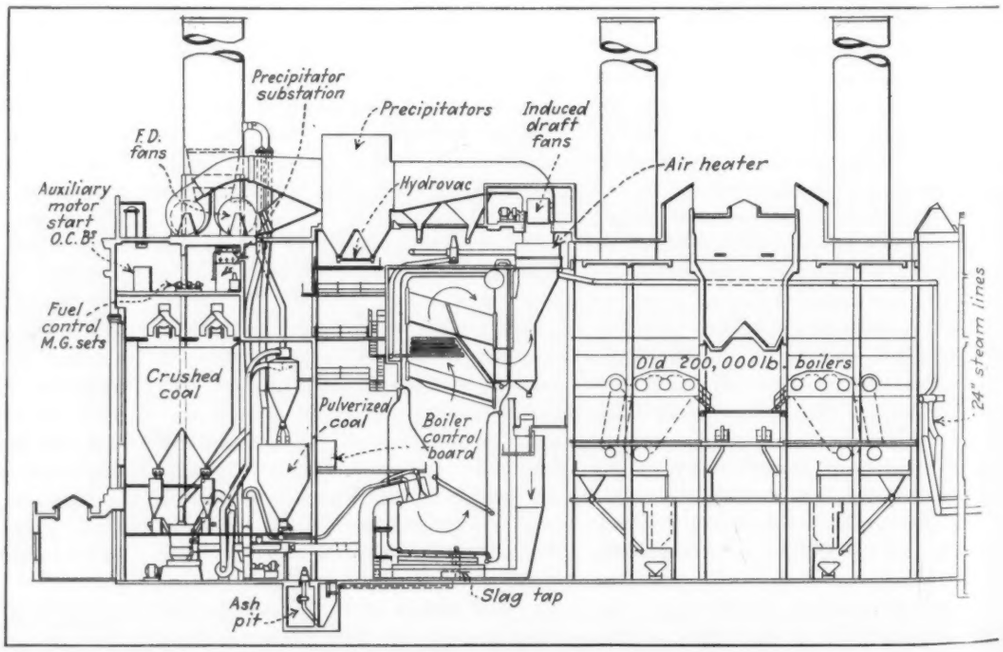
In addition to the usual complement of indicating and control devices required for operation of the turbo-generator, instruments are provided for measuring and recording, during starting operations, vibration in generator bearings, eccentricity of the turbine spindle, axial expansion of one bearing pedestal, and for indicating noise in the turbine glands. These instruments operate from a high-frequency (360-cycle) source. Leeds & Northrup "Micromax" recorders furnish a record of eccentricity, vibration and expansion, and indicating instruments in parallel with these give instantaneous readings. These recorders and indicating instruments, together with the noise indicator, are located on the turbine control board within view of the operator at the turbine throttle.

Oil fire risk minimized

To minimize possibility of disastrous turbo-generator fires which have occurred elsewhere, chiefly as a result of broken oil lines, every precaution has been taken to protect against oil fires. The governor valves are operated by a non-inflammable fluid, "Aroclor," which is supplied normally by a hydraulic turbine operated by the bearing oil with automatic throwover arrangement to shift the fluid supply to a motor-driven pump when the Aroclor drops below a predetermined pressure. An auxiliary-

Same floor area, but tripled boiler capacity

New boilers and coal-pulverizing equipment at left of boiler room. Intake and discharge tunnels pass under boiler room to river. Note comparative size of the old 200,000-lb. and new 600,000-lb. boilers.

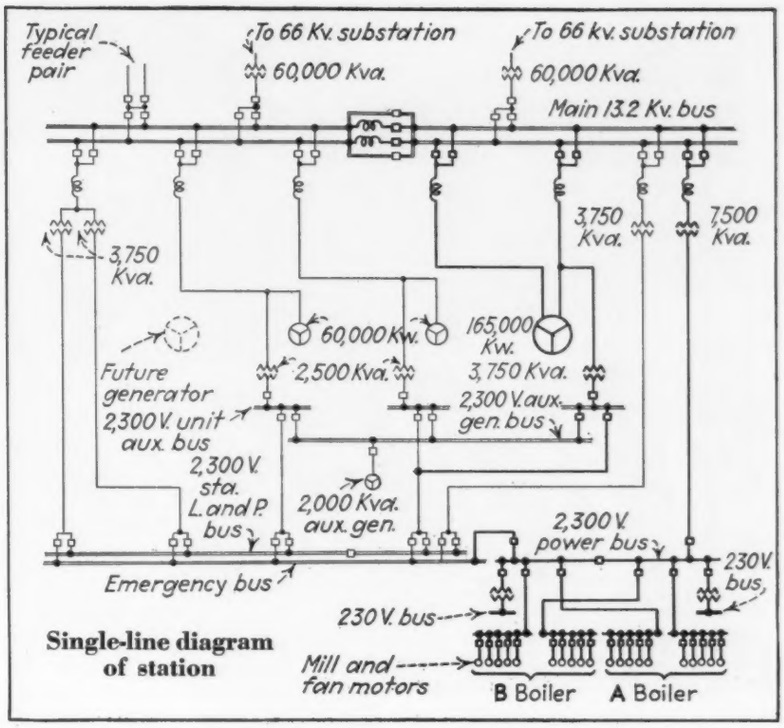


driven oil pump is automatically interlocked with the turning gear to insure adequate oil supply when the unit is operating at slow speeds. Extra precautions are taken to insure that electric conduits near the turbine are oil-tight. Steam hose, terminated with soldered conduit fittings, is used in place of conventional flexible conduit where flexibility is required. Lubricating oil storage pumps and reconditioning facilities are isolated in a separate oil room remote from the turbine. All oil piping is welded where practicable to minimize possibility of leakage.

A Westinghouse 113,000-sq.ft. single-pass surface condenser is located below the turbine with a 20,000-gal. hotwell (consisting of two cylindrical tanks) in the pit below the condenser. Due to space limitations it was necessary to fabricate the condenser in place prior to completion of the turbine foundation. The shell was completely field-welded in position.

The two circulating water pumps are of the vertical propeller type, having a combined capacity of not less than 115,000 g.p.m. Normally two pumps are in operation. The pumps are driven by 2,300-volt, 500-hp. vertical squirrel-cage motors which are designed for full-voltage starting. A solenoid-operated hand brake automatically prevents reversal of an idle pump.

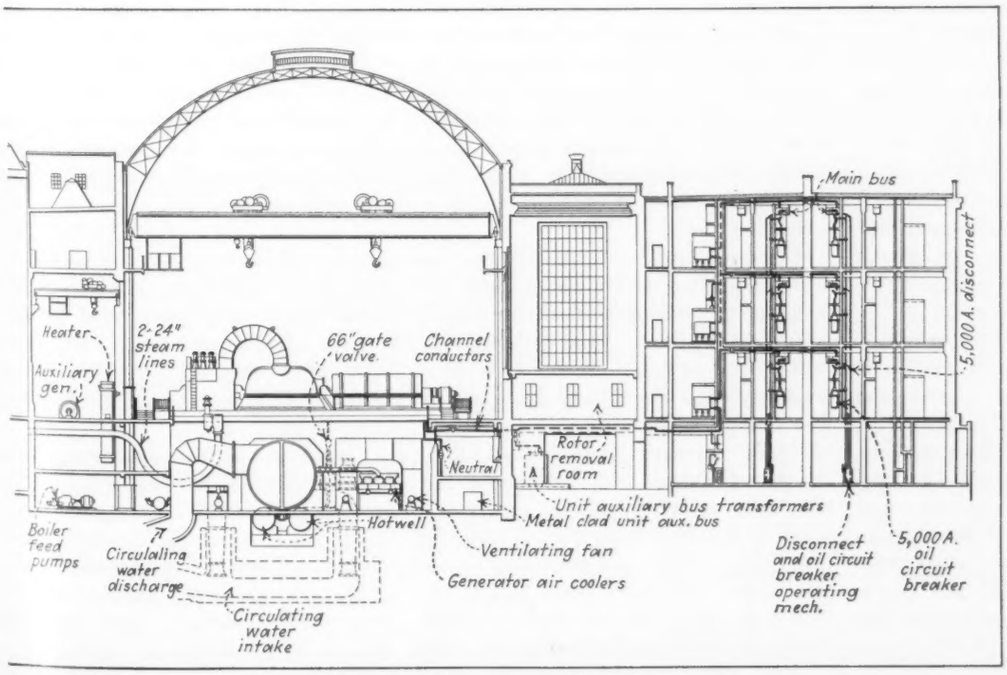
Two steam jet air pumps are provided, each consisting of three two-stage ejectors.



Single-line diagram of station

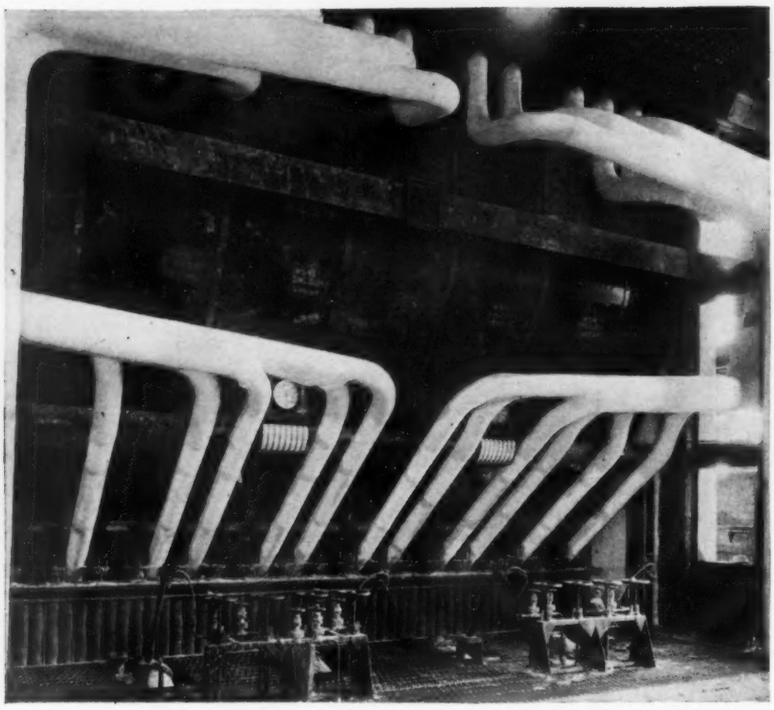
Boilers Operate at 425 Lb.—The two new pulverized fuel boilers are Babcock & Wilcox straight-tube, cross-drum type and designed for 600,000 lb. of steam per hour at 425-lb. gage, 850 deg. F., with feedwater entering the boiler at 325 deg. F. An inter-deck superheater maintains a final temperature of 850 deg. F. at 600,000-lb. load. The steam drums are all of welded construction.

In order to permit use of steam from the old 375-lb., 675-degree steam headers in the new turbine in emergency, and to permit use of steam from the new boilers for operation of the 60,000-kw. units during periods when the new turbine would be out of service, a connecting line has been installed in which a desuperheater is provided for use when steam from the high-temperature boilers is to be utilized in the low-temperature turbines. This arrangement will permit maximum utilization of the pulverized fuel boilers, which will burn a lower price fuel than can be handled in the older stoker-fired boilers.



Pulverized fuel

Although the old boilers in Richmond are stoker-fired, economic studies showed that with conditions at this plant pulverized fuel would prove most desirable for the new boilers. There was also the advantage of obtaining a wider selection of coal at lower prices. With slight modification, the new furnaces can be



600,000-lb. boiler from the firing aisle

adapted to oil or gas firing. Ash is removed by the slag-tapping process, sluiced to a pit and then pumped out to low ground areas near the station.

Two Ljungstrum air preheaters are provided for each boiler. With both preheaters in operation temperature of flue gas is reduced to 356 deg. F. under conditions of 600,000 lb. per hour steam output and the air for combustion is heated to 500 deg. F. At low loads part of the air can be bypassed to minimize corrosion due to low flow of gas temperatures.

Limitorque control mechanisms are used on all principal steam and water valves. The emergency control room, located outside the building and containing closing controls for all important existing steam and water valves, has been equipped with similar emergency controls for the new equipment.

Stacks, raw coal bunker and flue gas ducts exposed on the roof are all gunited on the interior surfaces for protection against corrosion.

The condensate from the turbine is returned to the boilers by two condensate pumps (one a spare) and three boiler feed pumps (one spare), all electrically driven. Both condensate pumps and two of the boiler feed pumps are fed from the turbine unit auxiliary power bus, with the remaining boiler feed pump supplied from the old main station light and power bus. The boiler feed pumps are constant speed, with 800-hp., 1,800-r.p.m., squirrel-cage, full-voltage starting motors, and the condensate pumps are variable-speed, through hydraulic couplings (described later), with 700-hp., 1,200-r.p.m., squirrel-cage motors, likewise full-voltage starting. Smoot control provides automatic regulation of condensate pump speed to maintain proper pressure in the feedwater headers.

Coal Preparation and Burning—The pulverized fuel system for the new boilers is the bin type, with two mills, two exhausters, two feeder blowers, eight pulverized coal burners and one pulverized coalbin for each boiler. The coal preparation equipment is isolated in a room separated from the boiler room proper by fireproof masonry walls. Emergency stop buttons under glass outside of this room shut down all equipment in the room in an emergency.

Crushed coal is supplied to the bunker located above the mills from new conveyors linked into the existing conveyor system. Four Richardson apron feed automatic scales of 10 tons capacity each are provided on one of the boilers. The mills are ball type, 20 tons capacity each, with 13,000-c.f.m. exhauster fans for conveying the fuel to the cyclone separators. Coal is removed from the cyclones by revolving motor-operated paddles or air locks. Selective gates below the air locks discharge the fuel to either of the screw conveyors or to the storage bin below. The capacity of each bin is sufficient to operate the boiler for four hours at 600,000 lb. steam output.

The screw conveyors permit storage of the output of any mill in either of the pulverized coal storage bins. From each bin the coal drops to a bank of eight motor-operated table type feeders which feed the coal to the primary air pipes connecting to the burners. The feeder blower discharges into a manifold, the outlets of which are valved to divide the air properly between the primary air pipes. The secondary air duct is provided with baffles to insure equal distribution of air to the burners. The pulverizing equipment from the air inlet of the mills to air inlet of feeder blowers is designed for negative pressure operation under normal conditions.

Automatic combustion control is obtained with the pneumatic Bailey control system.

Cottrell precipitators consisting of three banks per boiler remove the fly ash, which is deposited in hoppers below the precipitators and removed to the ashpit from this point by means of a hydrovactor. The electrical equipment associated with the precipitator is interlocked in the Cory interlock system.

Interlocking—The coal preparation and burning equipment is interlocked to insure proper sequence of starting and stopping. These interlocks shut down all preceding equipment in event of stoppage of any unit in the sequence. The coal preparation is interlocked separately from the burning equipment and each pulverizer unit system (one mill and its auxiliaries) is interlocked separately from the other unit system for that boiler. The sequence of starting operation in the interlock system is as shown in the following:

Coal Burning—(1) Induced-draft fan; (2) forced-draft fan; (3) feeder blower; (4) pulverized coal feeders.

Coal Preparation—(1) Air lock; (2) mill exhauster; (3) pulverizer mills; (4) crushed coal feeder; (5) coal scales.

Dampers, screw conveyors, coal scales and other devices in the operating sequence which are not electrically interlocked are provided with audible alarms. Test buttons located at certain equipment permit test operation of the device, while all other devices in the system are stationary.

Electronic Battery Charger

By PHILIP SPORN and G. G. LANGDON*

American Gas & Electric Company, New York

HERETOFORE, tube and copper oxide rectifier types of battery chargers have had poor voltage regulation and required rather frequent manual adjustment. Nevertheless they have been widely used in preference to rotating machines for charging small batteries and have proved to be remarkably free from maintenance other than tube replacement. Although rectifier type chargers have not been satisfactory for charging main station batteries, we have felt that an all-tube charger could be designed to overcome the present objections, and in February of last year we installed a recently developed all-tube charger having what are believed to be desired characteristics for charging a 60-cell station battery at Danville, Va.

As indicated in its characteristic curve (Fig. 2) the charger holds constant voltage up to a predetermined load and practically constant current above this load. Normally, therefore, the battery floats at a constant voltage which neither overcharges nor starves it. While the charger assists the battery on heavy loads, inherently it cannot be overloaded nor will it charge the battery at an excessive rate. Also, in case of a.c. supply failure and restoration, the charger is returned to service automatically after a short period required for filament preheating. A diagram of the circuit employed, together with a complete explanation of its functioning, is shown in Fig. 3.

The Danville battery charger has given very satisfactory service since its installation. Only one trouble developed, this defect causing decreased life of the FG-17 thyratron amplifier tubes. This trouble is believed to be due to the FG-17 grid circuit permitting too high a peak grid current and a rearrangement of the circuit has been made.

While this charger obviously cannot entirely eliminate the constant attention and maintenance which has been required previously by large and important storage batteries and electromechanical charging equipment, it is expected to decrease this maintenance considerably.

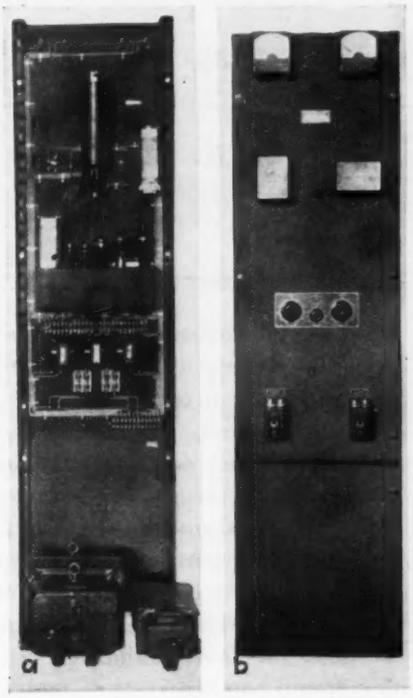


Fig. 1—Front and rear views of new electronic battery charger

Rated 3.5/3.2 kw., 240 volts, 60 cycles input; 140/129 volts, 25 amp. d.c. output.

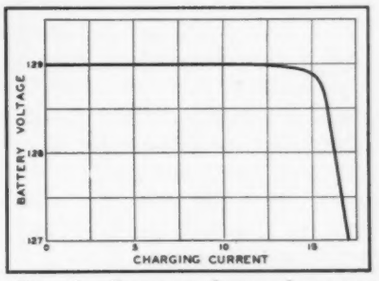


Fig. 2—Current-voltage characteristic of battery charger at typical voltage setting

Above curve is for a.c. supply voltages from 220 to 240 volts.

*This article is one of a series which should go far in awakening the power industry and productive industry to the merits of tubes for large control tasks. See ELECTRICAL WORLD, Feb. 2, Feb. 16, May 11, June 22, July 6, 1935.

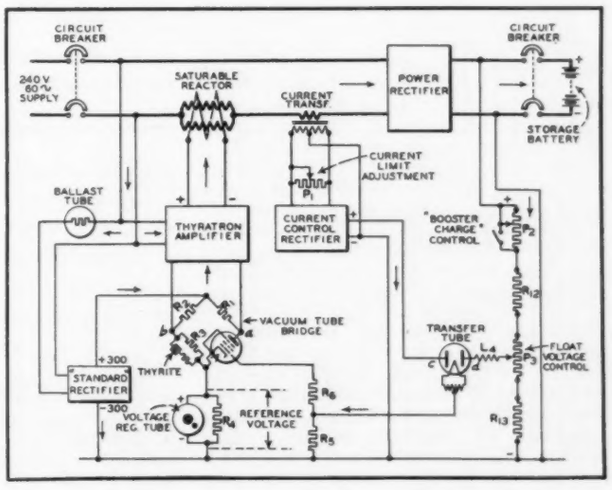
Fig. 3—Simplified diagram of battery charger

In the vacuum tube bridge circuit composed of R_1, R_2, R_3 and type 57 vacuum tube a change in the plate-to-cathode resistance of the tube unbalances the bridge and changes the voltage of point a with respect to point b. This voltage change is amplified in the thyratron amplifier and applied to the control or d.c. winding of the saturable reactor. The plate-to-cathode resistance of the bridge tube is determined by the d.c. potential of its control grid, which has a fixed or "reference" negative bias obtained across cathode resistor R_4, and a variable positive bias obtained across resistor R_5 as described later. (The fixed bias is independent of supply voltage or other variations within the operating range, due to the voltage regulator tube across R_4 and the ballast tubes in the auxiliary supply circuits.)

Considering the control transfer tube as a s.p.d.t. switch thrown to the right, the variable voltage across R_5 is proportional to the battery voltage and the system regulates the output voltage at a value depending on the setting of P_3. Considering the control transfer tube as a switch thrown to the left, regulation based on battery voltage ceases and current regulation is obtained as outlined below.

The current transformer provides a secondary voltage, roughly proportional to its primary current, that is rectified in the current control rectifier and applied across R_5, to provide a regulator tending to hold constant current into the power rectifier, the value of current depending on the setting of P_1.

The control transfer tube passes current from the right-hand plate d, giving voltage regulation, so long as it is positive with respect to cathode. As the current input to the power rectifier is increased, the voltage of plate c equals and finally exceeds the voltage at plate d, causing the cathode also to become positive with respect to d, shutting off current flow from d to cathode, and thus transferring from voltage regulation to current regulation.



System Voltage Regulation

Good Voltage Regulation Conserves System Investment—Each Device Finds a Logical Place in Rendering Proper Voltage Along With Continuity

By D. K. BLAKE

Member E.E.I.
Distribution Cost Subcommittee*
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Billions of dollars are now invested in electric utility systems to give good voltage to the consumer. This investment, of course, includes a great deal more than equipment for regulating voltage, for this equipment represents only a meager part of the total investment. Most of the money invested for providing good voltage is spent for land, buildings, underground conduit systems, poles, transformers and copper wire. Now, of course, all of the investments in these items are not for voltage regulation alone, but are inherently necessary to carry on the business whether voltage regulation is good or not. Besides, continuity of supply requires considerable expenditures in these same items. Voltage regulation is more than a matter of dollars for regulator equipment.

THREE considerations are necessary properly to appraise the investment for voltage regulation:

1. The complete investment in the system is for the distinct purpose of providing good electric service to the consumer.

2. Good voltage regulation and continuity are equally major aspects of good service, so that the billions of dollars invested are as important for voltage regulation as for continuity. Voltage regulation and continuity are like the two wings of an airplane; cripple one, and the other is useless.

3. It is an actual fact that large additional expenditures have been made in transmission lines, substations, real estate, distribution feeders and transformers, for no other reason than to improve voltage conditions to the consumer. It is true that these expenditures were usually looked upon as providing facilities for load growth, but, nevertheless, voltage improvement was the immediate occasion and too often proved to be the only benefit derived.

The relation between system investment and voltage regulation is conveniently summarized in Fig. 1.

A simple system is illustrated, having a total voltage regulation of 19 per cent (± 9.5) at a cost of $10,930,000, or $440 per kva. for a capacity of 25,000 kva., but without using any regulating equipment. Now, suppose 19 per cent total regulation should be considered too high for really good service and it is believed that it is a better business proposition to reduce this to 7 per cent or (± 3.5). Then, the same physical and electrical system would carry only 9,200 kva., and the same investment would be required except for the lower cost of 9,200 kva. generating capacity instead of 25,000 kva. The cost per kva. would be increased to $875. In order to carry 25,000 kva. at ± 3.5 per cent regulation, it would be necessary to do one of two things, either duplicate facilities or else add regulating equipment. To duplicate facilities is obviously an expensive method and would give a cost per kva. nearly as much as estimated for the reduced loading method.

The most obvious and simplest method, as well as the most economical, is to provide generator voltage regulators, they being entirely adequate for such a simple system. Such a simple system, however, does not exist in practice and other means of regulation must be considered.

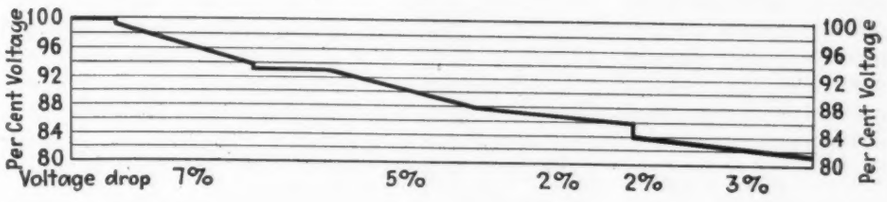
Tap-changing equipment can be added to correct for voltage drop up to the substation and thereby permit increasing the load on the same system up to 14,600 kva. at a cost of $595 per kva. Additional taps could be added at a small cost to compensate for the drop to the consumer if the distribution feeders have uniform length and loading. Again, such is not the case in practice, so it is desirable to consider individual feeder regulation. The use of induction feeder regulators in individual circuits enables the system to carry its original 25,000 kva. and at the same time give a maximum voltage range of ± 3.5 per cent. The investment in this case is reduced to $445 per kva., or slightly over 1 per cent more than the original layout having ± 9.5 per cent regulation.

Thus, it is seen that it was necessary in the first place to put ten million dollars into a system that gives a voltage regulation no better than 19 per cent, and that by investing an additional hundred thousand dollars for regulated voltage the effectiveness of the original ten million dollars has been greatly increased, because it provides the consumer with the highest order of service from the voltage point of view.

Whether or not ± 3.5 per cent or some other limit is the right one to choose to give the highest order of service consistent with revenue is not considered in this discussion. Also, this considers only the broad problem of regulation for a given system design which contains the principal divisions and distinctions commonly made in modern metropolitan systems. It is possible in many cases to show that a different system design, using smaller distribution substations, will permit bus regulation with transformer tap-changing equipment at a substantially lower investment than the larger substation with individual feeder regulators. In such cases the substations are usually small enough to supply the same area as a distribution feeder would otherwise supply. However, the size of substation permitting bus voltage regulation depends largely on the load density and the number of distribution feeders. Using a larger number of smaller substations is in effect increasing the length of the higher voltage (11-, 13- or 23-kv.) subtransmission circuits and reducing the length of the lower voltage (2.3-,

*This is one of the series of articles sponsored by the E.E.I. subcommittee on distribution costs.

Kva. capacity	Generation 25,000	Transmission 28,000	Substation 28,000	Feeder Trunk 34,000	Feeder Branch 39,000	Distribution Transformer 49,000	Secondary 56,000	Total	Dollars per Kva. of Gen. Sta. Load
Investment for 19% Voltage Drop									
	4,700,000	800,000	755,000	660,000	1,130,000	735,000	2,150,000	10,930,000	440



Investment for 7% Voltage Drop									
No regulating equipment (9,200 kva.)	1,730,000	800,000	755,000	660,000	1,130,000	735,000	2,150,000	8,060,000	875
Investment for ± 3.5% Regulation									
Automatic tap changers on substation transformers (14,600 kva.)	2,740,000	466,000	814,000	660,000	1,130,000	735,000	2,150,000	8,695,000	595
Feeder regulators (25,000 kva.)	4,700,000	800,000	940,000	660,000	1,130,000	735,000	2,150,000	11,115,000	445

Fig. 1—Hypothetical system with allocated voltage drops

Flow of power from the generators to the load inherently causes a voltage drop that may be reduced by either carrying less load on the system or compensated for by adding regulator equipment. Observe that about two-thirds of the voltage drop occurs in the distribution system. An expenditure of $100,000 is sufficient to place a $10,000,000 investment in a much superior earning position. It would be wrong to imply that this ratio for a hypothetical system holds for actual systems because there are too many variables and local circumstances causing higher regulating costs.
Nevertheless, the actual proportion of regulation cost to saving in investment is low enough to be attractive.

4- or 4.8-kv.) feeders to the individual load area. Thus, advantage is taken of the well-known relation wherein voltage drop is inversely proportional to the square of the voltage for the same load and distance.

Higher voltage distribution beneficial

Furthermore, eliminating the lower voltage and distributing direct at the higher voltage (11-, 13- or 23-kv.) gives a system with the least voltage drop and in general practically eliminates the variables in distribution circuits that ordinarily require individual feeder regulation.

Not only is the total regulation of the system reduced but it is considerably simplified, for then bus regulation at the generating station becomes much more practical. Whether or not this permits a substantial saving depends largely on whether the complete substation is omitted and larger capacity feeders are used, or whether just the transformers are omitted, using the same number of distribution feeders. If the former, the savings are obvious and may amount to as much as $500,000 or even more for the example illustrated in Fig. 1. If the latter, the savings, if any, are not obvious and there is a good probability that the system might cost about $200,000 or more additional.

In discussing the different systems and their cost of regulation, no account has been taken of continuity of supply. A single subtransmission circuit supplying several small radial substations obviously gives interruptions, for faults on the subtransmission circuit, not given by the one large station. The higher-voltage distribution system which eliminates substations makes some sacrifices in continuity of supply because of the greater load carried per circuit and the greater exposure per circuit. Small radial substations supplied from duplicate high-voltage supply or interconnected into a primary network give as good as or better continuity than the conventional radial system. The low-voltage secondary network, where economically applicable, gives the highest order of both voltage regulation and continuity of supply.

Distribution an ever-changing pattern

Distribution systems are not static, but are continually being changed or added to. For this reason it is bound to happen that some branches will become too long, or overloaded, with low voltage as a result. This is particularly serious in the secondary system because of the very low voltage (115/230 volts) involved. Furthermore, the distribution transformers may give bad voltage because of overloads.

Now, it is quite obvious that wherever these conditions exist the effect, as far as consumers at that point are concerned, is that all the investment made in the whole system to give them good voltage regulation is neutralized. The seriousness of the whole matter depends on what percentage of the consumers receive low voltage, because a system obviously cannot be perfect in this respect any more than in other respects. In order to get this information periodic voltage surveys are invaluable.

It seems that systematic voltage surveys are not as common in the industry as they should be. Many companies depend on consumer complaints as a measure of bad voltage conditions. One company inaugurated a rather elaborate periodic survey and found for the entire system that 24 per cent of the consumers had voltages below the limit they had chosen as the lowest for good service. In two of the four districts 29 and 33 per cent of the consumers had voltages below the good

service limit. However, the complaints for low voltage were less than one-tenth of 1 per cent. Obviously, the complaints are in no way a measure of the service rendered. Therefore, voltage surveys are essential for this purpose.

The data obtained from a voltage survey are also the best guide to engineers for making system changes and additions, by showing just what needs to be done to provide these consumers with the voltage which they deserve and which at the same time produces the additional revenue that the utility is entitled to receive.

In the case referred to, money was spent to correct the worst conditions, and a voltage survey two years after the first revealed that the 29 and 33 per cent consumers receiving voltage below the good service limit had been decreased to 15 and 11 per cent respectively. This is the most tangible evidence that can be obtained to make reasonably certain that the money spent to bring the voltage up where it belongs actually accomplishes that result. More than 15 per cent of the consumers in these districts had their voltage raised five volts or more, giving an estimated increase in revenue five to six times the cost of the survey. This amount, of course, may not be nearly adequate to pay for the cost of changes and additions to improve voltage. Shouldn't this expense be viewed as an expenditure that it was the intention to make originally on the basis that it is good business to maintain voltage at the consumers between certain upper and lower limits?

In one of the districts the original survey showed 18 per cent of the consumers below the low limit. No money was spent in this territory to improve conditions for several reasons, one being that the other districts were much worse. The next survey two years later revealed that the load growth had lowered voltage to the extent that 34 per cent of the consumers were receiving voltage below the good service limit. Thus, it is evident that periodic surveys are desirable as long as the load is increasing.

The method of making voltage surveys is beyond the scope of this discussion, but it is well to point out that the readings should be made as near to the consumer as possible, because it has been found that the secondary system (115/230 volts) accounts for a considerable percentage of low-voltage conditions. It is obvious that each secondary should be considered separate from the others, for the voltage on one secondary is no measure of the voltage on the others. An office study of secondary maps and circuits will do much to eliminate unnecessary readings.

Length and size of circuits

The methods used to correct bad voltage after it is found may involve rebuilding lines, adding new circuits, transformers or regulating equipment. A few circuits were selected at random for several companies and the voltage regulation on the longest single-phase branches was calculated and tabulated in the accompanying table. The current values assume that the transformers are fully loaded. Three of the four companies have a number of branches that have voltage drops too large to permit correction by the regulators back at the substation because the rest of the circuit would receive too much voltage or else the regulators would not have enough range. Therefore, special consideration must be given to the best solution.

The very first thing to consider is the possibility of reducing the length by connecting the remote end to an adjacent feeder and cutting the length into two shorter laterals. If these extensions are too long, then the next consideration should be to add a third conductor or change the size of the wire. Where these branch lines are one mile or longer recently developed pole-mounted regulating devices will have many applications at substantial savings, for they can be obtained at costs well below that required to rebuild the line.

When the cost to rebuild is close to, but under the cost of, adding regulating equipment good judgment will consider the probability of a new circuit being introduced to carry new load and at that time require this long branch to be cut up into shorter sections. In such an event the rebuilding cost may have been useful only during the few years before the new circuit was introduced and of no value afterward. On the other hand, a regulating device could readily be removed and used for similar conditions elsewhere. It would be a mistake to rebuild lines generally by installing additional conductors on the theory that three-phase will ultimately be required, for experience shows that the mileage of single-phase, overhead, two-wire circuits is several times the mileage of overhead three-phase circuits in domestic load areas. It is, therefore, essential to make an economic comparison for such cases in order to prevent excess investment.

Interspersing additional transformers

One of the most important regulation problems is that of the secondary system. Many secondary systems have given poor voltage due to excessively long runs with Nos. 2, 4 or 6 conductors. Many millions of dollars have been spent to change to larger size conductors. Several companies have recently made economic comparisons and found that money is to be saved by leaving the secondary conductors as they are and adding distribution transformers between the present ones. Simple calculations will show that the reduction in length is much more effective in reducing voltage drop than a change in conductor size. This is particularly true in the design for instantaneous voltage drops caused by motor-starting currents, for then the load is concentrated at the end and not distributed along the line.

In Fig. 2 is given an illustration of the relative costs of correcting to a 3 per cent instantaneous drop by three different methods. The auto-transformer has the lowest additional cost, but the extra transformer has the

Frequent Occurrence of High Primary Voltage Drop Should Receive Correction in Some Manner

Selected branches are all for single-phase, 2,300-volt, two-wire circuits

Circuit No.	Kva.	Amp.	Feet	Wire Size	Per Cent Regulation
1	96	44	10,900	6	8.8
2	99	45	15,100	4	8.3
3	114	52	10,500	6	10.2
4	159	72.8	3,240	4	2.9
5	130	59.5	5,100	4	3.8
			Company W		
1	94	41	8,800	2	2.9
2	90	39	12,000	4	5.5
3	50	22	10,000	4	2.7
4	95	41	5,000	6	3.8
5	58	25	8,350	2	1.7
6	150	65	12,000	2	6.3
7	218	94	6,150	6	10.6
8	130	57	4,200	6	4.4
9	167	73	6,600	6	9.0
10	40	18	11,600	4	2.5
11	88	38	13,400	6	9.5
12	230	100	4,100	6	7.5
			Company B		
1	353	161	2,000	4	3.9
2	357	164	3,950	4 & 6	8.2
3	100	46	2,800	1 & 6	2.3
4	188	86	2,600	6	7.5
5	205	94	2,000	4	2.3
6	340	156	3,300	4	6.3
7	237	109	4,600	1/0	3.4
8	265	121	3,000	4	4.4
9	385	176	6,400	4	13.8
			Company C		
1	200	92	2,100	6	2.6
2	65	30	3,400	2	0.83
3	150	69	2,100	2	1.2
4	135	62	2,100	2	1.07
5	68	31	2,100	6	1.2
6	165	76	3,700	6	3.4
7	196	90	3,700	1/0	1.9
8	107	49	2,000	6	1.8

lowest cost per kva. and is to be preferred where load growth is reasonably expected. After small increase to a density of about 15 kw. per 1,000 ft., the "flicker" problem disappears and the auto-transformers are unnecessary, as it is then time to add the second transformer anyway. Nevertheless, there are many places on the system where load growth is questionable and auto-transformers† can be used to advantage. There are also cases involving heavier starting currents at one place on the secondary where only one auto-transformer is required. If "flicker" voltages 5 per cent or more are permissible, then of course the example given does not apply for 20 amp., but does apply for correspondingly higher amperes. This pertains to 115-volt motors on one side of a secondary.

The development of regulators that are fast enough to correct sudden voltage changes on a distribution system to prevent flicker involves the problem, at least theoretically, of having the regulator effect correction as fast as the time-temperature characteristics of the lamp itself. Devices employing vacuum tubes have been investigated for this purpose, and although commercially not satisfactory for general application to circuits supplying distributed loads, it is expected that further development will yield better results.

For flicker attack impedance

It is believed that the fundamental solution to the flicker problem is to reduce the impedance of the circuit. In addition to the methods already considered for secondary systems, series capacitors may be occasionally used in primary circuits as an alternative to circuit additions or changes as recently discussed in the ELECTRICAL WORLD.‡ It is obvious that a fast regulating device placed at the source end of a circuit supplying distributed loads will cause a sudden voltage rise at the source end that would produce light changes about as objectionable as the dips at the far end of the circuit.

On systems having high reactance and low power factor loads shunt capacitors may be used by reducing the line current and improving the power factor. A circuit having a line and transformer impedance of 5 per cent resistance and 20 per cent reactance might have a regulation at 60 per cent p.f. of 19 per cent. A tap-changing regulating equipment to correct this would cost about $5,000 installed. A shunt capacitor with automatic control would cost about $12,000 installed; this would raise the power factor to unity and reduce the regulation to 3 per cent, which may easily be taken care of by the over-all system regulation. The line current would be reduced to 60 per cent, and to pay for the extra $7,000 would require $17.50 per kva. credit for reduced system demand on a 1,000-kva. circuit. The losses saved would amount to about $625 per year at 5 mills per kilowatt-hour, or if capitalized at 12.5 per cent would represent an investment of $5,000.

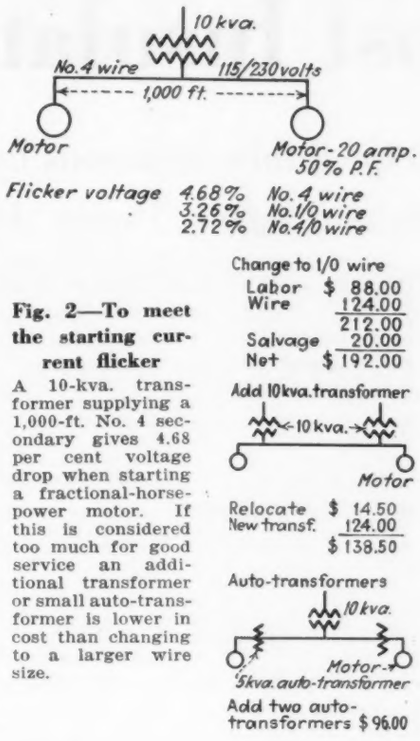


Fig. 2—To meet the starting current flicker

A 10-kva. transformer supplying a 1,000-ft. No. 4 secondary gives 4.68 per cent voltage drop when starting a fractional-horsepower motor. If this is considered too much for good service an additional transformer or small auto-transformer is lower in cost than changing to a larger wire size.

Rural line special problem

Rural lines present one of the most difficult regulation problems. The lines are long, with small wire. The transformers are small, have relatively high impedance and are frequently overloaded. The revenue is small, but good regulation is essential for electric cooking as well as for lighting. Numerous attempts have been made to develop individual regulators for the distribution transformer supplying two or more consumers, but so far the cost has been such that it is less expensive to add an extra distribution transformer and shorten or eliminate the secondary main altogether by giving the consumer an individual transformer. Individual regulators for each consumer have been studied, but so far have an unreasonable cost. It, therefore, seems that regulation of rural circuits must rely principally on the use of primary regulating devices. These devices recently developed consist of pole-type induction regulators, four-step, tap-changing regulators and one- or two-step boosters. Thus, different grades of regulating equipment are now available at costs consistent with the revenue derived.

The principal difficulty with primary regulation of rural lines in some territories (such as the irrigation territory of the Pacific Coast) is the high ratio of motor loads to lighting and cooking loads. The diversity between the two is such that peak load on the circuit is not concurrent with the domestic peak, with the result that the maximum boost is not available when needed most. It is quite probable that such circumstances as these will permit secondary regulation for the relatively few domestic customers at a lower cost than primary regulation for the combined motor load and domestic load.

"——to See Ourselves as Others See Us"

WE HOPE that some of our own politicians, both within and without the supply industry, will take notice of what is happening on the other side of the Atlantic and think more than twice before, under the guise of reorganizing distribution, they initiate a period of confusion in this country which would set back development for years. It is easy to start a boulder rolling down hill, but almost impossible to be certain that it will not smash up something valuable before it comes to rest at the bottom.—*The Electrician*, London.

†"Auto-transformers Reduce Light Flicker Complaints," A. B. Jaquith, G. H. Fieldler, ELECTRICAL WORLD, March 24, 1934.

‡"Why Not Series Capacitors for Distribution Feeders," C. L. Dudley and E. H. Snyder, ELECTRICAL WORLD, June 30, 1934.

Line-Post Insulators Prove

New Design Helps Public Relations by Minimizing Radio Interference, Saves Money by Increasing Ground Clearance and Reduces Cleaning Costs

By FRED B. DOOLITTLE
Radio Engineer
Southern California Edison Company, Ltd.

DISCOVERIES which lead to scientific advances are often made by accident or coincidence. Such was the case in the development of the "line-post insulator," the fundamental idea of which was conceived more than four years ago as a result of observations made in the testing laboratories of the Southern California Edison Company, Ltd. In the course of investigating various insulators and line materials to find those which could be used on high-voltage lines without causing radio interference, a large number of samples were tested in the presence of various manufacturers' representatives.

After testing many pin-type insulators of standard and "treated" designs with generally disappointing results, a fuse holder similar to Fig. 1 was tried. To every one's surprise, very high potential could be applied between the fuse clips and the mounting bracket without causing radio interference. The porcelain insulating medium in this fuse holder consisted of a hollow tube closed at the upper end and having "petticoats" on the outer surface very similar to those on some of the "fog-type" pin-type insulators which previously had been tested and found to cause radio interference at much lower voltages.

The similarity in appearance of the porcelain in the fuse holder and the pin-type insulator led to the thought that the difference in the voltage at which radio interference started must be due to the pin. This opinion was verified by filling the porcelain tube with a conductor and applying potential between the mounting bracket and the conductor, this combination showing results that are comparable to those obtained on the pin-type insulators.

Tests were made at night in order that corona might be observed in the dark and the conclusion, jestingly suggested, was that from the standpoint of radio interference fuse holders made the best line insulators.

Apparently taking the test results seriously, one manufacturer's representative early the next morning appeared before Edison company engineers with an idea for a new type of insulator. This manufacturer had been conducting similar tests at his plant during a period of a year or more previous and the results of this test confirmed his own findings. His idea was soon translated into working drawings of the first line-post insulator, at that time called the "pinless pin-type insulator."

Samples of the new insulators for service at a line voltage of 66 kv. were soon received and passed rigorous radio interference tests without difficulty. Minor changes were made in the original design to eliminate the possibility of interference originating at the line and tie wires. Inspection of the accompanying illustration will show that the 66-kv. insulator is a one-piece porcelain cylinder approximately 20 in. high with an outer surface having petticoats very similar to those of the fog-type suspension insulator. One end is grooved to receive the line conductor and tie wires. The other end is cemented into a base which, by means of a stud screwing into the base, permits the insulator to be mounted on top of the crossarm similar to the conventional pin-type design.

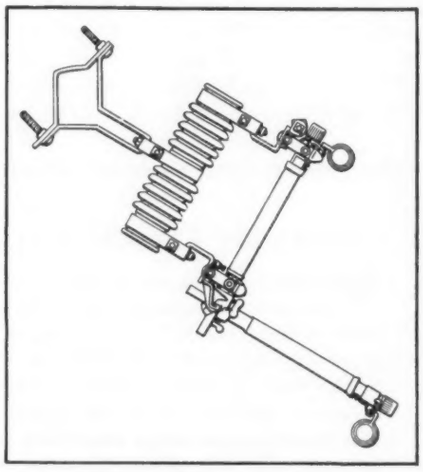


Fig. 1—Forerunner of the line-post insulator—the conventional fuse holder

Assured by the results of radio interference, flashover and mechanical tests on the new insulator and anticipating protests from property owners in a certain locality should existing poles be replaced by larger poles, the Southern California Edison Company decided to use line-post insulators instead of taller poles on about 2 miles of this line. In so doing the company departed from its standard construction of suspension insulators for 66-kv. lines, a radical change in practice, as the use of pin-type insulators heretofore had been avoided on lines of this voltage because of the probability of creating radio interference.

No more radio interference

The reinsulated line extends through a residential section into a business district (see Fig. 2). In nearly three years of operation at 66 kv. there have been no radio interference complaints. Attempts have been made at various times to detect any radio interference that might be caused by this line by having the line energized and de-energized while listening under it with an automobile radio receiver. No difference in noise level was ever observed on these tests, there being some slight interference from other sources, which of course was not affected by switching the 66-kv. line.

Having found an insulator which gives satisfactory performance with pin-type construction on 66-kv. lines, it is of some interest to consider a theory which explains why line-post

Worth on 66-Kv. Line

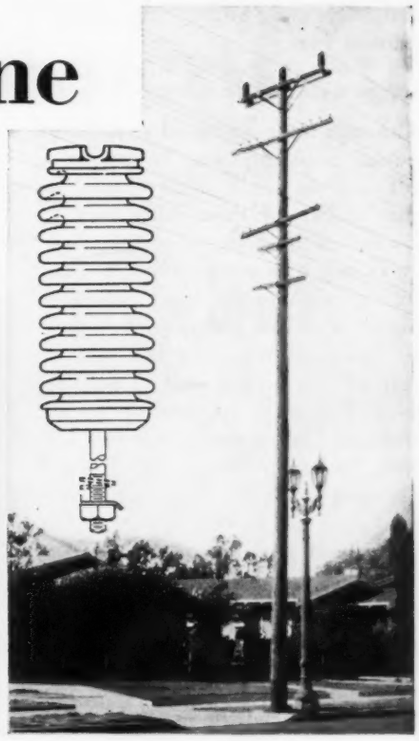


Fig. 2—Original installation of line-post insulators on the Southern California Edison system
At left, construction in the business section and, at right, in the residential area

insulators are inherently less likely to cause radio interference than conventional pin-type insulators. With an insulator causing interference, tests show that the same intensity of interference is measured whether the instrument is connected directly in the ground lead to the insulator pin or with the instrument connected through a condenser of low radio frequency impedance to the energized side of the insulator. This demonstrated that the interference is due to a radio-frequency current flowing through the transmission conductor and insulator capacitance and is not due to shock excitation of some portion of the circuit.

Cleaning easy on line-post insulators

Since the capacitance of the line-post insulator is very small compared to that of a pin-type insulator, it offers a much higher radio frequency impedance to the flow of current in the line-to-ground path and therefore limits this current to a low value or prevents its flow entirely. This low capacitance also minimizes the charging current at power frequency and in so doing reduces the probability of interference being produced by excessive current density at the contact between the tie wire and porcelain if a metal cap is not used.

Laboratory tests on line-post insulators, in which attempts were made to simulate field conditions of extreme contamination and moisture, produced results which raised serious question as to the serviceability of the insulators on lines subject to severe exposure along the seacoast. Specifically, in the laboratory with the insulators subjected to salt water spray, very severe periodic arcs were observed which extended as much as two-thirds of the length of the insulators. There was enough current involved in these arcs momentarily to dip the voltage of the test transformer, and it was therefore not known whether or not complete flashover would have occurred had the voltage been maintained.

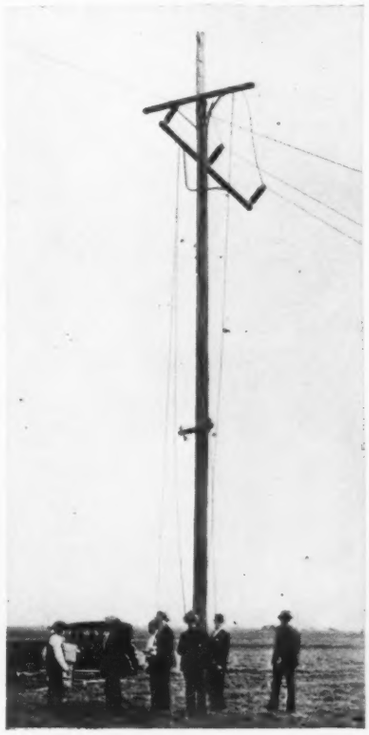


Fig. 3—Mechanical test of line-post insulators made by cutting conductors
Damage to pole and crossarm is apparent, but the insulators were unharmed.

A field test then was made by installing a line-post insulator on an operating 66-kv. line in a location of severe exposure and allowing it to remain without cleaning until it flashed over. This occurred in almost exactly one year from the time the insulator was installed, which was considered satisfactory performance, because if this insulator had been cleaned according to the schedule applying to the suspension insulators on the same line the flashover would have been prevented.

After flashing over the insulator was cleaned and the line re-energized, the damage to the insulator being slight. Cleaning of line-post insulators is a very much easier opera-

tion than cleaning of conventional suspension strings.

Design withstands severe stresses

Although the mechanical strength of line-post insulators was known as a result of tests, some doubt existed as to the ability of these insulators to withstand such shock as might result from failure of a conductor in a span. Before going into the more extensive application of line-post insulators they were tested by replacing the suspension insulators on one pole of a transmission line with the new design of insulators. The conductor was No. 4/0 copper, the span length 165 ft. and the tension 1,485 lb. The center conductor was cut in the center of the span without any apparent effect on the insulators. Then one of the outside conductors was similarly cut, with the result shown in Fig. 3, the pole split and the arm pulled loose, but there was no damage to the insulators. This test convinced the most skeptical and it was decided to use line-post insulators on about 1 mile of new line extending from the end of a tower line in the mountains to the substation in the city of Santa Barbara. Fig. 4 shows this line insulated with line-post insulators for two circuits at 66 kv. and two circuits at 16 kv. There have been no radio interference complaints from residents in the vicinity of this line and consequently no radio interference tests have been made.

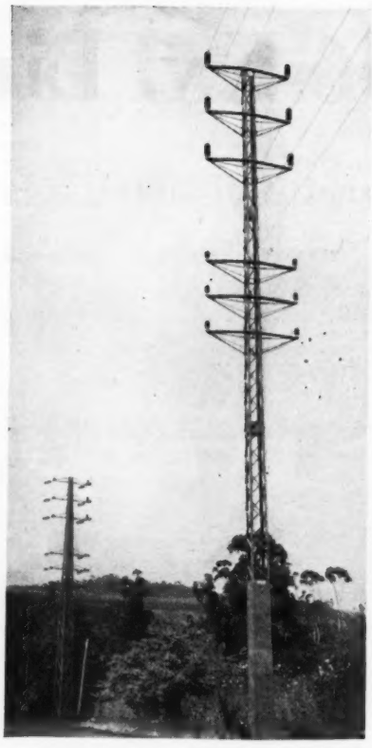
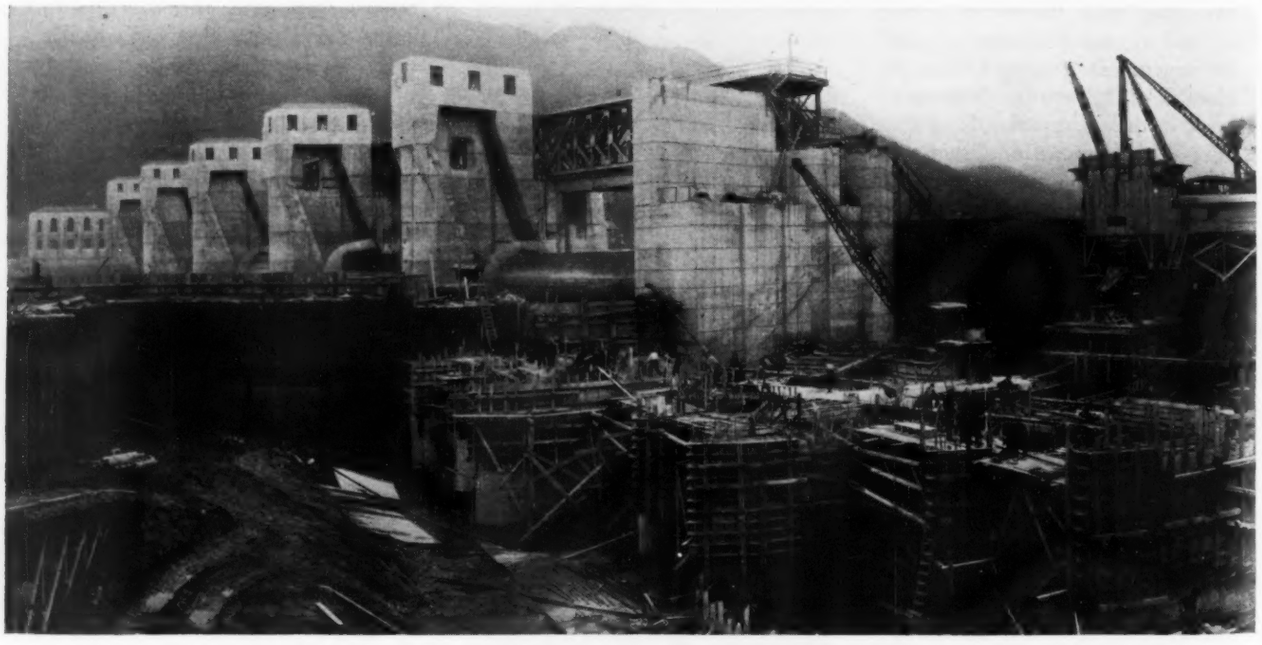


Fig. 4—Line-post insulators on steel tower line carrying two 66-kv. circuits (above) and two 16-kv. (below)

To January, 1935, the Southern California Edison Company, Ltd., has 612 line-post insulators in service on 66-kv. lines. About 400 of these are on the two lines pictured in Figs. 2 and 4. The remaining units are scattered over the system, a considerable number having been used to replace suspension insulator strings where it was necessary to raise the conductors to clear trees.

The advantage of freedom from radio interference, the inconspicuous, neat appearance and the ease of cleaning of line-post insulators, together with the advantages common to them and conventional pin-type insulators, of less pole height for the same ground clearance and lower cost than suspension strings, all point to a bright future for this newcomer in the field of high-voltage line insulation.

Almost a Unique Activity on Utility Systems



Construction is progressing here on the Marmet hydro plant of the Kanawha Valley Power Company and also at the London hydro plant, both being built on the Kanawha River, near Charleston, W. Va., under federal license. The dams and locks are being built by the United States government for navigation purposes and the power company is entitled, under the license, to develop the power thus made available. The output from these plants will feed the 44-kv. transmission system of the Appalachian Electric Power Company. The two plants are almost identical and will each have an installed capacity of 18,000 kva. in three units of 6,000 kva. The hydraulic units are propeller type, operating under a nominal head of 23 ft.—two adjustable blade units at Marmet and one at London. Plants will be automatic in operation, with starting and stopping under remote supervisory control.

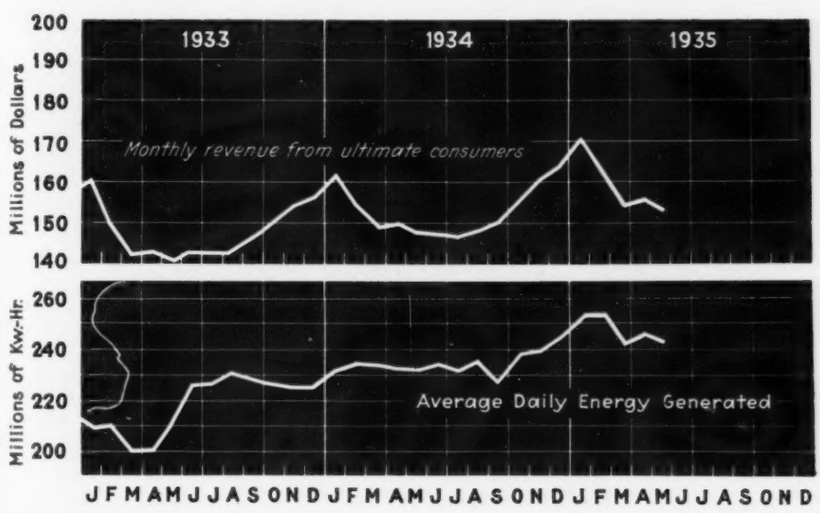
May Revenue Up 3.6 per Cent

With 5 per cent more output, operations continue ahead of last year's, approaching 1929 levels. During the year 475,000 customers were added.

GAINS over 1934 in May operations of electric light and power companies amounted to 3.6 per cent as to revenue from ultimate consumers, 5.0 per cent as to energy generated and 3.9 per cent as to sales. The aggregate revenue, as announced by the Edison Electric Institute, was $153,202,700, a decrease of 1.7 per cent from April. Such a decrease is normal in this season. Since the beginning of the year, the figures have been closely trailing those for 1929, month by month, the disparity in May being only 1.6 per cent. Changes in net are not indicated because data are not collected on operating expenses and taxes.

Energy generated, totaling 7,458,500,000 kw.-hr., surpassed that of the month in 1934 by 5 per cent, and in 1933 by 15 per cent. Sales to ultimate consumers, after allowing for energy imported over the Canadian border, energy purchased from other sources and losses in transmission and distribution, were 6,145,000,000 kw.-hr. This is only 1 per cent less than in the like month of 1929, and 1.7 per cent less than in 1930.

All classes of consumers are using more energy than a year ago, with the exception of a small miscellaneous group, as Table III shows. In domestic consumption the rate of increase, 9.7 per cent, is the largest since last August. Heavy appliances are steadily filling up the summer valley in the domestic load.



Nearly 25,000,000 customers

Sales to retail commercial customers are up to pre-depression levels and were greater than in May of any other year, except 1930. Wholesale energy sales have been on the upgrade since December, though at a somewhat slower rate than last year. May sales were slightly greater than April, and 1.6 per cent above May, 1934. Energy for railroad operations for the second consecutive month showed a gain of about 15 per cent over last year.

More customers are being served than ever before, the total, according to the E.E.I., being 24,961,273, compared with 24,486,473 a year ago. During the twelvemonth period ended May 31, the number of domestic customers increased by about 457,000 to 20,653,652, and retail commercial by 39,000 to 3,736,936; wholesale commercial decreased by 25,000 to 499,583. The increase during May in domestic customers was 66,368.

Table I—Monthly Revenue from Ultimate Consumers and Energy Output of Central Stations in the United States

Compared with Corresponding Month of Previous Year

Month 1935	Revenue from Ultimate Consumers		Energy-Generated, Millions of Kw.-Hr.*					
			Total		Hydro		Fuel	
	Thousands of Dollars	Per Cent Inc.	Gen.	Per Cent Inc.	Gen.	Per Cent Inc.	Gen.	Per Cent Inc.
May	153,203†	+3.6	7,549	+5.0	3,548	+18.7	4,001	—4.8
April	156,069	+4.1	7,368	+5.3	3,423	+ 4.2	3,945	+6.7
March	155,884	+4.1	7,553	+4.0	3,397	+15.8	4,156	—4.1
February	162,470	+4.9	7,057	+7.4	2,846	+33.2	4,211	—5.0

Table II—Regional Revenue and Energy Output in May, 1935

Compared with Corresponding Month of Previous Year

Geographical Region	Revenue from Ult. Consumers†		Energy Generated, Millions of Kw.-Hr.*					
			Total		Hydro		Fuel	
	Thousands of Dollars	Per Cent Inc.	Gen.	Per Cent Inc.	Gen.	Per Cent Inc.	Gen.	Per Cent Inc.
United States	153,203	+3.6	7,549	+ 5.0	3,548	+18.7	4,001	— 4.8
New England	12,894	+2.8	514	+ 3.3	288	— 4.0	226	+14.8
Middle Atlantic	41,138	+3.9	1,850	+ 3.6	694	+17.1	1,156	— 3.1
East No. Central	34,981	+5.5	1,790	+ 4.3	239	+45.0	1,551	0
West No. Central	12,788	+1.9	517	+14.4	206	+93.3	311	— 9.8
South Atlantic, East So. Central	19,226	+5.2	929 / 314	+ 6.7 / +12.2	685 / 260	+36.4 / +18.0	244 / 54	—33.7 / + 7.7
West So. Central	8,524	+3.8	370	+ 4.7	37	+174.2	333	— 2.3
Mountain	4,435	+6.9	265	+10.1	216	+ 7.9	49	+21.0
Pacific	15,220	—2.4	1,000	0	923	+ 4.7	77	—33.9

*By courtesy of U. S. Geological Survey, with deductions for operations not regarded as central station.
†Preliminary.

Table III—Allocation of Energy May, 1935

Compared with Corresponding Month of Previous Year

Class of Service	Millions of Kw.-Hr.	Per Cent Inc.
Total for distribution*	7,545	+ 4.1
Lost in transmission, etc.	1,400	+ 5.0
Sold to ultimate consumers	6,145	+ 3.9
Domestic	1,060	+ 9.7
Com'l, small light and power	1,099	+ 6.2
Com'l, large light and power	3,346	+ 1.6
Municipal street lighting	175	+ 4.2
Railways—street, interurban	354	+ 1.3
Railroads—electrified steam	66	+14.8
Municipal and miscellaneous	45	— 5.1

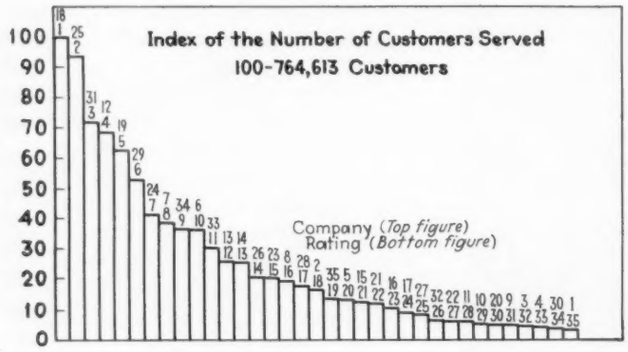
*Generated, purchased from other sources, imported less energy used in railway and other departments.

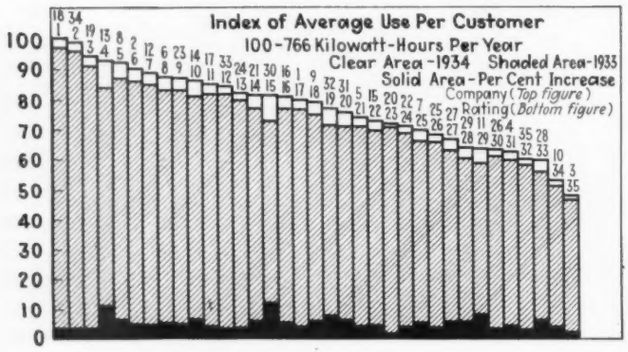
The Measure of a Selling Job

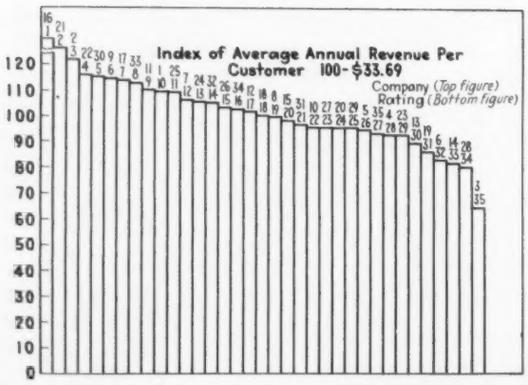
How One Power Company Has Charted "Electrical World's" Analysis of 1934 Merchandising Activities to Show How It Rates With Other Companies in Commercial Proficiency

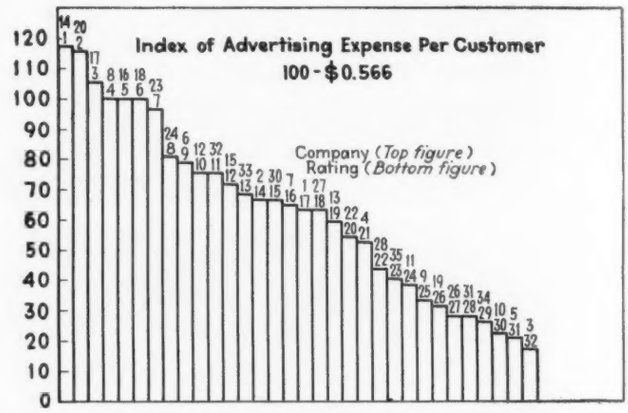
A STUDY of the merchandising activities of something more than 100 power companies during the year 1934 was published in ELECTRICAL WORLD of March 2. This detailed tabulation reported the sales of the major domestic appliances by the utility companies themselves and by the local dealers in their territories as nearly as they could estimate. It also presented the average annual domestic consumption, the average annual sales of appliances per consumer, the number of domestic consumers per salesman, the expenditure per consumer for advertising and other related facts.

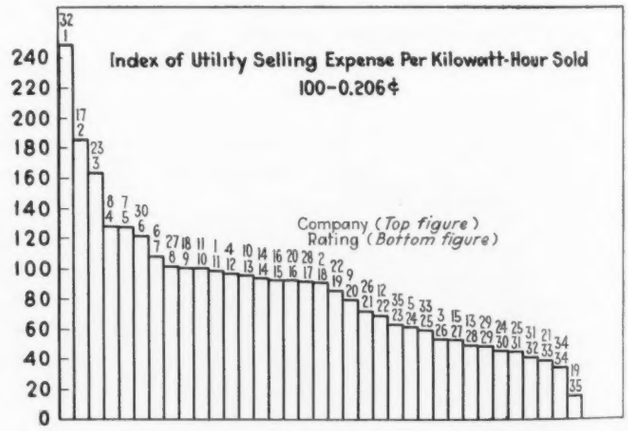
The wide variance in apparent methods followed and in the results obtained raised many questions. For instance, why should one company employ one salesman per 583 consumers and another assign a man to cover 25,938? And why should one company spend 6 cents per customer for advertising to build domestic load and another $1.45? And these ques-

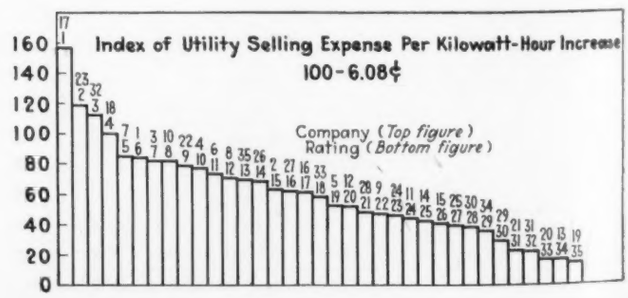


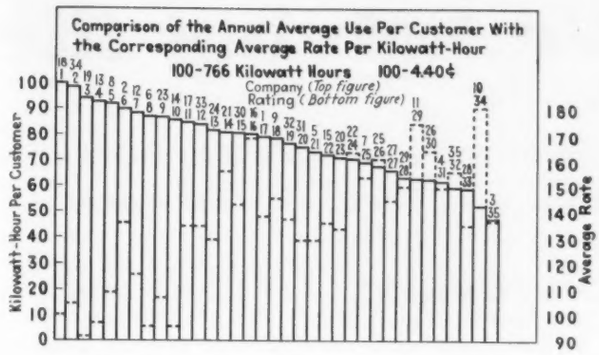

Index of Average Use Per Customer
100-766 Kilowatt-Hours Per Year
Clear Area-1934 Shaded Area-1933
Solid Area-Per Cent Increase
Company (Top figure)
Rating (Bottom figure)

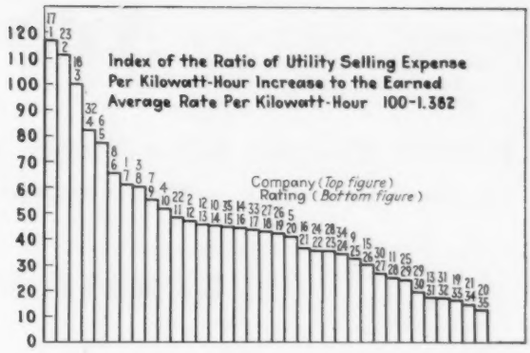


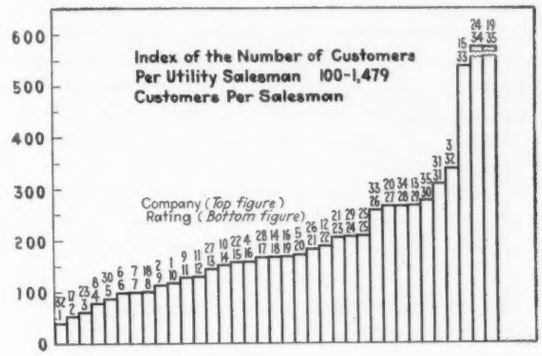


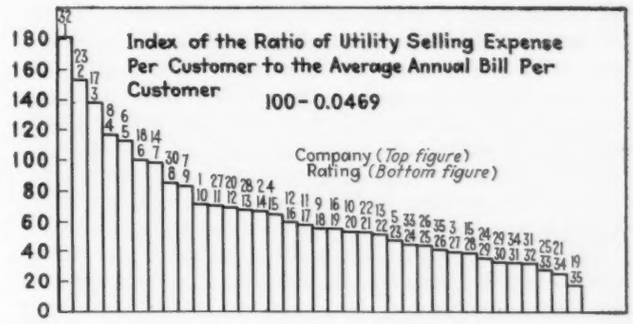


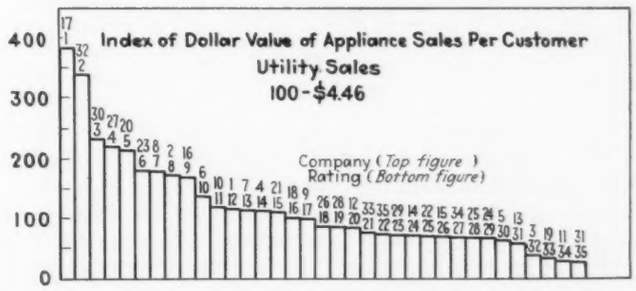



Comparison of the Annual Average Use Per Customer With the Corresponding Average Rate Per Kilowatt-Hour
100-766 Kilowatt Hours 100-4.40¢
Company (Top figure)
Rating (Bottom figure)
Kilowatt-Hour Per Customer
Average Rate


Index of the Ratio of Utility Selling Expense Per Kilowatt-Hour Increase to the Earned Average Rate Per Kilowatt-Hour 100-1.382
Company (Top figure)
Rating (Bottom figure)


Index of the Number of Customers Per Utility Salesman 100-1,479 Customers Per Salesman
Company (Top figure)
Rating (Bottom figure)


Index of the Ratio of Utility Selling Expense Per Customer to the Average Annual Bill Per Customer 100-0.0469
Company (Top figure)
Rating (Bottom figure)



tions were particularly pertinent because the 1934 performance of these important power companies showed records all the way up and down the scale for what appeared to be extremely good to very bad.

These charts show how one power company has analyzed these figures to determine how it stood in the picture. This study was based on a comparison of 35 of the organizations listed in the original tabulation and each is identified by the number under which it appeared. The position of any one of them can be followed through the series, and as the companies represented can recognize their own figures, each can take its own message from the accompanying charts.

A similar analysis of total domestic appliance sales by power companies during the first half of this year compared with the same period of 1934 will be published in ELECTRICAL WORLD August 31. This comparison will hereafter be made semi-annually as a basis for a continuing check of its own performance by any company.

In a Nutshell

A few weeks ago, after I became head of the Boston Edison Company, I was asked to express in a few words to the 3,200 employees of that company my conception of a public utility's responsibility to the communities which it serves. In response to that request I wrote out the following very short statement:

To meet the challenge of present-day conditions a public utility engaged in the distribution of electricity should possess:

1. A plant which provides an adequate and dependable supply of electricity.

2. Rates low enough to permit the abundant use of our service, and which assure a fair return to the investor.

3. A personnel which understands the value of courteous and considerate attention to the wishes expressed by our customers.

FRANK D. COMERFORD,
President Boston Edison Company
Chairman New England Power Association.

Are We Solving the

Power People Like Their Record of Success—Public Likes Their Service—But G-Men Want to Run the Business

By RAYMOND S. TOMPKINS

THE answer would seem to be "No," in spite of the fact that the country expends more sound and fury upon it at the moment than upon any other. Yet it is far from being as hopeless as the national debt problem. Everybody feels that somehow or other the power problem will be settled. Indeed, many are not sure exactly what the power problem is. There are New Dealers who will not believe that, but it is true. But will the debt problem ever be settled? There is a question, indeed!

For the year ending July 1, 1936, we shall have a net deficit of $3,892,000,000. By that time the whole federal depression deficit will have reached $16,000,000,000. President Roosevelt has proposed a tax plan to meet this deficit. It will raise $340,000,000, if the tax collectors are lucky, or less than one-tenth of the deficit for just one year, and about one-fiftieth of the total deficit for the depression period.

Thus, compared to the national debt problem the power problem is practically "in the bag." Yet from the tumult and shouting you would think it was the power problem that had the country flat on its back, while for all the concern the government shows about the debt problem you would think it didn't owe a dime.

Now, in trying to determine just what the power problem is, it should be understood that a good deal of the noise about it has been made recently by the power people themselves. The rest of it is being made by New Dealers, Brain Trusters, social reformers, government ownership advocates and similar gentry. They want to subdue the power business, break it up, bedevil it. It is not always easy to understand what they have in mind, but they seem to desire government ownership. But there is a theory that if a deeply indebted and experimentally inclined socialistic government could get hold of the power business and run it, it could pay off its debt and continue its socialistic experiments regardless of their cost, depending upon the people to pay for them when they paid their light and power bills.

ON THE other hand, the power people—that is, the present workers and owners of this power business—want to keep it. This is more natural and easier for most Americans to understand than the other attitude. There are two simple reasons why the present owners and workers want to keep it: First, they like it, and, second, they make money at it. They like it because they have built it up themselves, and they make money at it because they work hard at it. There is no secret about how much they make. In 1934 the workers made $325,000,000 and the owners (the security holders) made $666,000,000. The people who got this money spent it right where they got it, and they enjoyed spending it because they had earned it.

How have the investors and workers in this business made it succeed? The answer to this question is simpler than the answers to any of the others. They have made it succeed, first, by manufacturing a service so efficient that you know you can depend on it; second, by fixing the price so low that virtually anybody who can buy anything at all can buy it, and, third, by going out and boosting it and selling it with such a fanfare of trumpets and such persistence and expertness that a great many people became convinced it must be a very desirable thing to buy. They have found out that it is.

THERE is no direct evidence that the social reformers object to these methods of conducting the power business. Sometimes it seems as though they object to the results, because they have been profitable. But it is scarcely possible to conduct a business by these methods and not make it profitable. At any rate one of the impressive results of the methods is that today a great deal of housekeeping in the United States is done by electricity, to the great delight of the housekeepers, and the "electrical home" is a modern American legend. The power people have done this. Possibly they should be ashamed of themselves. That is one of the real "power problems" of the time, to know whether to be proud or ashamed of a piece of business efficiency.

At any rate, they accomplished this, first, by inventing handsome, desirable little machines to do commonplace things electrically; then by getting people to buy them. Was ironing a shirt a repulsive job, hot and wearisome? The power people invented a little shiny flatiron that would iron the shirt electrically. Was making waffles in the kitchen a thankless task for mother or the cook on Sunday mornings, with all that trotting back and forth for each batch of hot ones? The power people eliminated long waits between waffles by bringing a miniature waffle factory, graceful and gorgeous, right in to the breakfast table. Had the household washing of clothes become synonymous with slavery? The power people invented the electric washing machine.

In a word, the power people learned the black art of getting their customers to enjoy the use of electricity. The same art has been learned by the automobile business, the ice cream business, the grocery business, the hot dog business, the toothpaste business. It is not a typically American art, but a human art well understood in every part of the world, but it has had extraordinary development in the United States by energy, ingenuity and enterprise, and in no business has its development been more extraordinary than in the power business. Today, under the New Deal, the curious theory is fostered that there is something sinister about this art. However, there it is! Be it art or a racket, it is business, and not "typically American" but universal.

Plainly these results—widespread housekeeping by

"Power Problem"?

electricity—were produced by following the laws of nature, not by forcing them. This is clear from a survey of the composite electrical American home. Running this home involves laundry work, housecleaning, cooking, heating, sewing, keeping food, and so on. Electricity learned to do them all, but practice, or experience or taste or something else decreed that electricity was not going to do as much in some of them as in others. We used 20,000,000 electric irons to do our family ironing in 1934, but in dishwashing we were still in the horse-and-buggy age, with only 110,000 electric dishwashers in the whole country. We cleaned house with about 10,000,000 electric vacuum cleaners, but we heated water for baths with only 300,000 electric water heaters. We made toast on 9,608,239 electric toasters, but we made little Mary's school dresses and little Johnny's school shirts on only 3,250,000 electric sewing machines. Also, while we used 6,020,000 electric refrigerators to preserve the family foodstuffs, we cooked them on only 1,255,750 electric kitchen ranges.

Including everything, Americans now keep house with about 100,000,000 electrical appliances. The figure was exactly 86,650,441 in 1934, but it is constantly growing. There is no known limit to the things electricity will do, hence no known maximum "enjoyment of electricity." The power people conceive it to be their duty to discover more things for it to do, to find the capital for applying the discoveries, and to reduce the cost of using them.

IF AMERICANS keep house electrically, they do business electrically, too. Virtually nothing that we eat, drink, wear or use can be said not to have had the "electrical touch" at some time, and to have been improved by it. Today they even electrocute the weevils in wheat. These bugs, breeding and multiplying in grain stored in railroad grain elevators all over the country, have been costing us two billion dollars a year. Now, J. H. Davis, chief engineer of electric traction of the Baltimore & Ohio Railroad, has developed an electrical "death ray" which bumps off the weevils and doesn't hurt the wheat. This "death ray," we learn, may turn out to be fatal not only to the weevils in wheat but to the bugs in flour, in dried figs and fruits, in tobacco, cocoa beans, nuts, and to every other kind of varmint that tries to eat us out of house and home. Some despondent scientists predict that insects will eventually drive mankind off the earth and take complete possession of it. This "death ray" of Mr. Davis should encourage them and enable many of us once more to look a cockroach in the face without wincing.

Electricity now builds our bridges, makes our steel, runs our trains, operates our airplane factories, caps our bottles and ages our liquor. It has been harnessed and trained to do these things by men with a passion and a talent for the art. These men constitute the power business. It has no real identity apart from them and it never will have.

One important electrical invention the power people do not claim entire credit for, probably one of the most important of all. This is the invention of the "decreasing price." As practically everybody knows, the more electricity you use the lower the rate you pay for it. In 1929, when the country used 9,772,788,000 kw.-hr., the average rate per kilowatt-hour was 6.33 cents and the national light and power bill was $618,798,800. In 1934 the country used 12,797,635,000 kw.-hr., the rate dropped to 5.30 cents per kilowatt-hour and the nation's light and power bill was $677,697,300. If the rate had stayed the same in 1934 as it was in 1929 the 1934 bill would have been $810,000,000.

This decreasing price principle is not entirely the invention of the power people, but in part is a natural law accompanying the efficient manufacture and distribution of electricity. But some day it may come to be looked upon as an invention, a strange, old-fashioned one, out of date and contradictory—a declining price schedule in a nation where only fixed high prices are patriotic.

POSSIBLY, though, electricity will always be an outlaw from this high price-fixing principle. You can destroy wheat and cotton to keep prices up and you can kill little pigs. But can you kill kilowatts to keep up the price of "juice"? The question may some day agitate a large and busy American government bureau in Washington. The advance guard of social reform clamors for changes. The Tugwellians chant "We will make America over!" They present the country with the power problem, which must be solved ere we perish. We have, in this wandering essay, been trying to isolate that problem. So far as it is discernible to the naked, and perhaps untutored, eye it appears to be simply the problem whether the power people who have introduced the country to the enjoyment of this electricity which they have harnessed and trained to work shall be permitted to run the business or whether it shall be slowly enfolded and, finally, completely absorbed by the "G-men."

G-men, as every movie-goer now knows, are "government men." Specifically, they are sleuths, grim, inexorable, dauntless. They are incomparable as detectives, splendid in moving pictures. How would they be in the light and power business? There is no way of telling, but you may get an indication from a glance at the following things the T.V.A. men have been doing or will do when they begin running the government power business down there:

1. Spend money without authorization by the Comptroller-General.
2. Sell power at less than cost of production pending building up of a market—then hike the price.
3. Build transmission systems competing with private lines.
4. Block all private developments that might interfere with T.V.A. plans.

A few weeks ago Congress, by defeating amendments to the T.V.A. bill, which would have stopped such high-handed operation, told the T.V.A. men (today's G-men in the power business), to go ahead.

G-MEN are admirable citizens in their field, which is the field of warfare on criminals. But when G-men in the power and light business begin to use the technique used by G-men in the crime war business it may well behoove the simple citizen, now accustomed to the innocent enjoyment of such electricity as he thinks he can use, to consider what may lie ahead of him. Perhaps a visit from a gentleman who shoves his foot in the door,

[*Continued on page 80*]

One of a Series of Intimate Talks with Industry Executives

DeBard on Room to Grow

An Interview by

EARL WHITEHORNE

ELECTRICAL men have found a new vision in the last few years. It is going to work a revolution in the world of electricity.

It is interesting how these things happen. An industry will come into existence behind an idea. It will develop in a definite direction because the men who lead it are thinking that way. Iron-bound traditions grow up and battle ahead against all odds. Then one day they run into conditions that they cannot conquer and along comes somebody and points an easier way that has been waiting all the time. To my mind, Davis M. DeBard, who heads new-business development in the vast Stone & Webster operating system, is doing this kind of a John the Baptist job for the power industry right now.

Electric service to the home began in terms of better light for everybody. But when the dream broadened and we saw electricity relieving household drudgery and bringing comfort in innumerable ways, it was no longer a service for the masses. To cook, heat water, refrigerate, wash dishes and clothes, iron and clean electrically costs money. It meant expensive appliances and more consumption than the poor man could afford at prevailing rates. So only the flatiron is in general use. Only half the connected homes use a cleaner. Nearly half the domestic consumers of the country are in the unprofitable class. We have been trying by main strength to make families without spare cash buy things designed, priced and presented to attract the carriage trade, as they used to call it in the horse-and-surrey days. Now into this somewhat discouraging picture comes DeBard, with an entirely different approach to the whole problem of domestic load building.

DeBard says: "The automobile industry has always sold up—first a Ford and then a Buick, and it has put all America on wheels. But we have attempted to electrify the homes with Packard and Cadillac models. It can't be done that way. For only the upper strata of the market can buy on that scale.

"So with the rates coming down and urgent need for rapid large-scale domestic load development, the power companies are searching to see how to develop the mass market for electricity. The average residence today consumes 640 kw.-hr. a year. But a completely electrified home needs from 6,000 to 7,000 kw.-hr. That means electric cooking and water heating sold not to the richer 10 per cent, but to all customers. In my opinion the only obstacle is our approach."

"What can we do?" I asked DeBard.

"The English companies have worked it out," he answered. "They found that with no heavy-duty appliances at the end of the wire there was little or no profit from their investment per home. But with a little more capital expenditure they were able to earn from 5 to 10 per cent by fashioning the service to fit the market. They rented appliances and built them rugged and reasonable in cost.

Water heater crux of problem

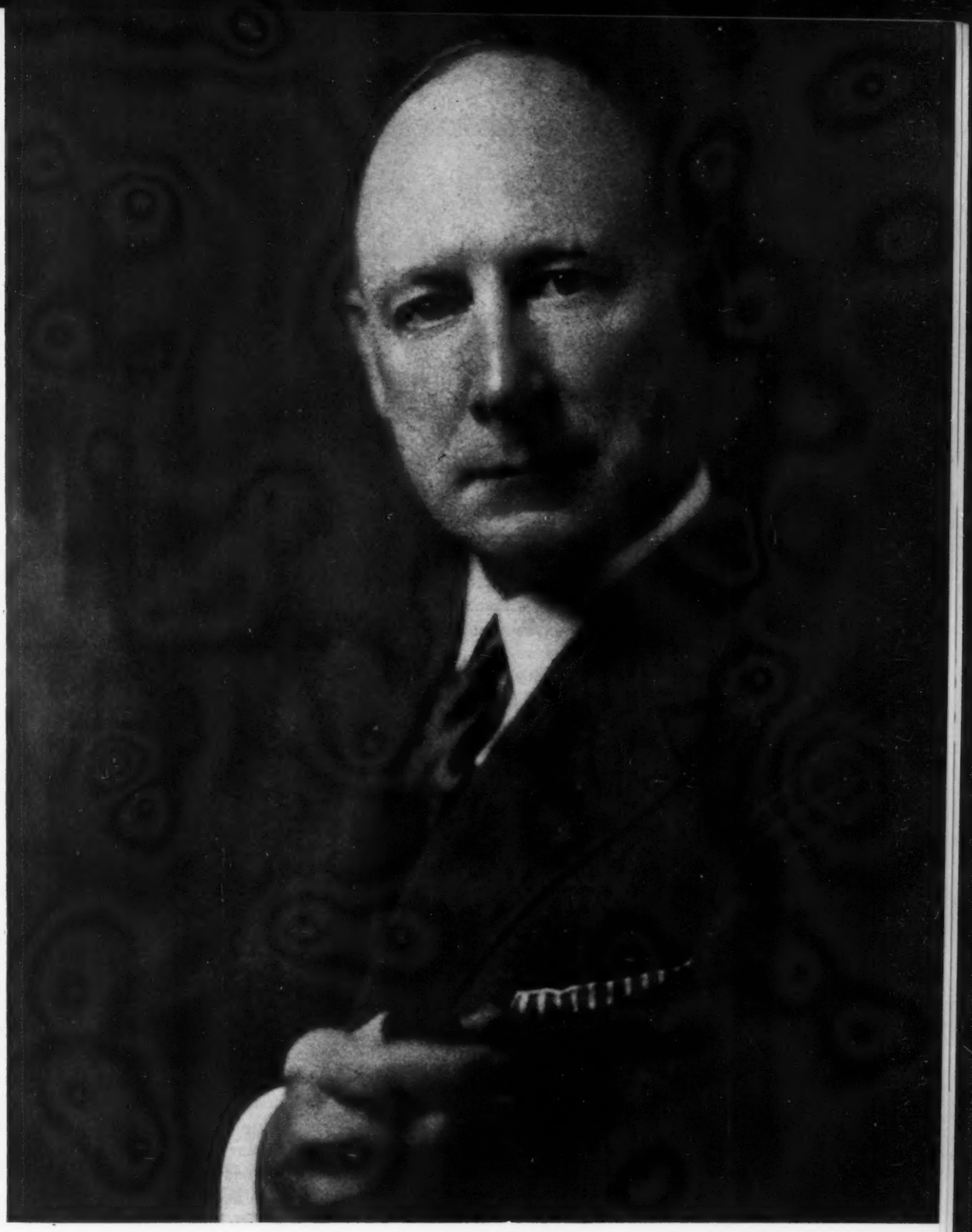
"That there is something here for us has already been proved in the past two years by many companies that have been installing ranges, water heaters and liftop refrigerators on the trial-rental plans, designed to interest the lower income market. The average consumption of these companies already exceeds the national average and is growing rapidly. It is pointing out the vast waiting 'room to grow' that can be opened up by every utility that will adjust its service to the present living standards of the masses.

"I believe that the water heater is the key log in the jam," DeBard continued. "People must have hot water. But American practice has always been extravagant and expensive. We pipe a house for both hot and cold water and provide a central heater. Then we proceed to waste all the water in the pipe until the hot water comes and all the heat left in the pipe when we turn off the faucet. That waste makes electric water heating costly. But the English have licked this also. They pipe for cold water only and install an inexpensive two- or three-gallon electric heater at the sink and by the basin. They save the cost of piping and waste no water and no heat.

"This idea is now being developed by some of our supervised gas companies in America with great success. It now remains to put electric water heating on the same economical basis and similar small local heaters are being tried out. Thermostats are set to give water at 150 deg. at the sink, 125 deg. for the bath and 115 deg. at the basin. The trial rental plan for 30- and 50-gal. gas and electric water heaters during the past two years has boosted the number placed on the lines for previous corresponding periods from three to seven times. It is increasing output at small investment. With the addition of the smaller heaters placed at point of use and offered on a trial-rental plan the water heater load will be doubled in a few years."

"It looks to me," I said, "as though these appealing benefits to builder, householder and utility should force open the door for large volume electric service to this mass market, that we never have been able to reach."

"It will give us a Model T to sell to everybody," said DeBard, "a combination of water heating and cooking at a mass price. And that's what we've been waiting for."



DAVIS MEAD DeBARD, sales engineer for the Stone & Webster Service Corporation and the Engineers Public Service Corporation, who guides the load development activities of a group of 125 operating companies in 34 states and nine foreign countries and is pioneering a new approach to the mass market.

ELECTRICAL WORLD

L. W. W. MORROW · EDITOR

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Lobby Headlines Accented

THE utility lobby investigation is a typical example of political strategy. It struck oil quickly in the Herron incident and made it a gusher in newspaper headlines that were designed to lead the public and Congress to believe that this asinine happening was typical of the practice and policies of all utilities. This "betrayal from within" has been damaging to the cause of the utilities and will be exploited to the limit by their political enemies. On the other side is the Corcoran-Brewster incident, which should be equally effective in aiding the utilities. But this has not the power of New Deal propaganda behind it and will be minimized instead of exploited.

We are indeed at a low ebb in national affairs when Congressmen are swayed to legislative action by either lobby investigation propaganda or by Administration patronage, without any regard to facts or the good of the country. The utilities presented their case in factual terms to show Congress that the utility holding bill was destructive and not in the public interest. They supplemented this action by asking their employees, stockholders and friends to study the facts and the proposed legislation and then write or wire their representatives in Washington. Both actions were and are necessary to get favorable political action under present conditions.

Naturally enough, in such a large undertaking there are likely to be mistakes and bad practices. Possibly some utility executives ordered employees to get letters and telegrams instead of calling them together, explaining the situation and asking for their co-operation as a sane and legitimate endeavor to prevent destructive and unnecessary legislation. No utility man will condone mistakes or approve wrong actions, whether major or minor. In such a widespread endeavor, however, there were foolish and unintelligent incidents, and, at least in the Herron case, some utterly wrong actions. But a few incidents do not characterize the campaign or indicate general industry policy and practice. Yet the Herron case is made the source of propaganda and generalization in order that the enemies of the industry may discount the effect of the true facts about the legislation and to offset the honest and open expressions of opinions of citizens so universally sent in to Congress in recent weeks.

Our whole system is tainted by this lack of able and courageous legislators who weigh facts and act for the welfare of the country. Never was administrative pressure exerted as it is in this Congress; never, in self-defense, was business forced to fight destructive legislation by "lobby" methods to overcome this administrative pressure, and never was Congress so swayed back and forth by influences that are generally political and selfish instead of factual and unselfish. We hope the true facts and the constructive opposition to the utility legislation will not sink under the lobby investigation propaganda. We hope Congressional leadership will come forward to lead this country back to prosperity, with common sense and public welfare as guiding stars in the management of national affairs. Defeat of the destructive utility legislation may well be the start of this return to national sanity. We hope so.

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Economics of Regulation

BY THE fact that the utility is responsible for the quality of the service it supplies it has been assumed by tacit consent that the utility is also responsible for the quality of performance of the devices that use its service. This is a perfectly reasonable assumption and one that the utility does not contest so long as it covers only the effect of service quality on performance quality. But when performance quality is not what it should be then it seems hardly fair to lay the whole blame on the utility.

There can be no doubt but that the growing importance of lighting flicker as an industry problem is due to two considerations. One of these is the increasing number of motor applications particularly in domestic use. The setting up of rules limiting motor-starting currents is an approach to the solution of this problem and in addition motors have been vastly improved to help the situation. The other consideration lies in electric lamps themselves. As lamps have been made more efficient they have become more sensitive to voltage variations. The amount of metal in a lamp filament, particularly one among the smaller sizes, is not capable of sufficient heat storage to ride over even a slight variation of voltage without appreciable and perceptible loss of incandescence. The sensitivity of lamps in this respect has now become so great that the causes of flicker extend themselves from motor starting to include the regular pulsations of compression even from some household refrigerators.

If it were possible for utility systems to be so

heavily built that voltage could be kept absolutely constant at the customer's service entrance the flicker problem would not then be licked. There would still remain the customer's wiring, which is notoriously deficient in regard to the present-day demands on it. Unfortunately the utility is unable to convince the customer of this condition in every case, or in fact in more than a very few cases. And then, ten to one, if the customer is convinced, he will put up with the flicker rather than spend any money rewiring his house.

The utility has assumed, or, rather, has accepted, the responsibility for correction of lighting flicker. Flicker is caused by apparatus connected to utility lines and manifests itself in electric lamps, and over neither of these has the utility very much, if any, control. The utility cannot divest itself of this responsibility because the public will not allow it to do so. But just in fair play, isn't it pretty nearly time for all concerned to study the over-all economics of the situation with a view to sharing the burdens and bringing about improvements at lowest cost?

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Farm Service Must Be Good

RURAL SERVICE must be good service and good service is not synonymous with cheap construction and equipment. A rural line is exposed and is relatively inaccessible to operating and maintenance crews. A farm with electrical equipment must have continuous service for brooders, pumps, the range and other devices or damage will occur. Farm people and farm animals must be safeguarded against electric shocks and fire hazards. All these things make it economical and necessary to look upon rural electric service as a more severe specification than overhead service in a city.

We do not believe in tradition, but some of the things we have seen and heard recently on rural construction and equipment give us concern. There are a lot of nonsensical ideas and suggestions abroad that should be killed. The "nuts" who wish to do something different are having their innings. Manufacturers are designing and making special apparatus, hardware, etc., upon request with a very little first cost reduction as compared to the decrease in life, reliability and safety. At best, rural electrification is of doubtful economic justification, and it will be just too bad to have utility and federal rural lines put up based on freak designs with resultant short life, poor service and costly maintenance.

There are a few engineers who have built rural lines and served farms over a period of years. These experienced men should be called upon at once to give some good advice to Washington and to the utilities who are embarking upon rural projects. There is no merit to a single construction or equipment specification, but a statement of principles and a citation of good and bad engineering practice would save the government and the industry much money and greater grief in the days to come.

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The Cost and Value of New Business

REAL study is being given today to the cost of building load. With it is coming knowledge and discrimination that power company management has not had before. It is a natural product of the present economic pressure. Rates are going down and expenses going up these days and cost control has become as important in commercial activities as in operating. So easy-going sales accounting is on the way out. Selling is to become a more exact science based on the analysis of recorded experience and the law of averages.

But costs must be related to values, because what a man is justified in spending for sales promotion and operations depends on the business that comes out of it. Which raises the question, What is new business worth to a power company? And we wonder why it is that estimated annual revenue is always reported by the sales department in terms of only one year's revenue. Shouldn't the average life load value of any new installation be credited to the sales department, as the measure of its accomplishment and the basis of its right to spend money?

When a manufacturer takes an order for equipment for a great power station, for example, he enters the full total of the contract in his record of orders received. Some of it may not be billed in the calendar year. But it is a sale—all of it. Why, then, should a power company figure the value of a range or a refrigerator, or any other domestic, commercial or industrial appliance, in terms of only one year's revenue? For if experience shows that a range stays in use five years, on the average, it is worth more to get it on the lines than if its life expectancy is one year or two or three. The whole picture of the value of new business is distorted, therefore, by the prevailing practice of writing down the annual revenue as one year's consumption, and the performance of the sales department is thrown quite out of perspective.

It is easier, of course, to figure average life on domestic load than on industrial or commercial installations. But there is always some basis for conservative estimates, and the gain should be credited in full to the sales operation, if costs are to be accurately calculated and appropriations intelligently balanced to the possibilities. Certainly it would be a great gain to the industry if a uniform system of sales accounting could be generally adopted so that the cost and value of new business could be clearly reflected, on a basis comparable for all companies. It would make everybody's experience helpful and lead to better selling all around.

Impasse Reached by Conferees; Utility Lobby Probe Continues

Administration's representatives rebuffed by conferees on Wheeler-Rayburn bill — Lobby investigators probe Associated Gas affairs — Communications Commission joins inquiry — Dow makes statement

House and Senate conferees on the Wheeler-Rayburn bill abandoned their session last week subject to the call of Chairman Wheeler because of failure to agree on the participation in the conferences of Dozier Devane of the Federal Power Commission legal staff and Benjamin V. Cohen of the Public Works Administration. The dispute began when Senator Wheeler and Representative Rayburn, chairmen of the committees in charge of the legislation and authors of the original bill, insisted that Messrs. Devane and Cohen be permitted to sit in at the conferences. Objecting to the suggestion on the ground that they were outsiders and had no right in law or reason to be present, Representative Huddleston of Alabama, together with two other members of the group, walked out of the meeting, with the result that the conference broke up in confusion. Reports from Washington indicate that Administration forces will endeavor to break the deadlock this week.

Bill's constitutionality

An opinion prepared by the law firm of Winthrop, Stimson, Putnam & Roberts, at the request of Wendell L. Willkie, president of the Commonwealth & Southern Corporation, points out clearly the unconstitutionality of the Wheeler-Rayburn bill in the form in which it passed both the House and the Senate. "If Congress has the power sought to be exercised in either the Senate or the House drafts of the Wheeler-Rayburn bill," the opinion states, "then there would be no business which would not be subject to the exercise of the power of Congress over interstate commerce, irrespective of how local such business might be." Both acts, the opinion maintains, clearly offend against the constitutional division of powers between Congress and the states recently enunciated by the Supreme Court in the NRA case.

Senate lobbying hearings

In the meantime, the Senate, continuing its hearings on lobbying activities in connection with the bill, turned its attention this week to affairs of the Associated Gas & Electric Company. Figures were presented showing that personally owned companies of H. C. Hopson averaged over $560,000 a year profit during depression years on revenue received from the system, which was then omitting dividends. Mr. Hopson, described by a representative of the New York State committee investigating utilities as the "master mind" of the utility organization, is now missing, the committee brought out as it called five Associated officials and three of its own investigators to show that his whereabouts are unknown.

Acting upon testimony in the lobby investigation, Dwight H. Brown, Secretary of State, ordered suspension of all permits to sell securities of the Associated Gas & Electric System in Missouri.

The Federal Communications Commission on July 23 joined the lobbying inquiry by directing eight communication companies to supply specific information by August 15 as to the extent of propaganda, whether unauthorized signatures were signed to telegrams and the total of any records that were destroyed.

In commenting on what was brought to light in the lobbying investigation, Alex Dow, president of the Detroit Edison Company, said in a letter to stockholders: "The particular occasion for now writing you is to assure you that the industry at large, including the Edison Electric Institute and the Committee of Public Utility Executives, most thoroughly disapproves of the methods which appear to have been used by certain employees of the Associated Gas & Electric Company to simulate a bombardment of telegrams directed to Senators and Representatives. If the industry were in a position to discipline these blunderers it would surely do so, but the industry has had no way of stopping any one from buying into it, and the newspaper story of the present foolishness is an excellent illustration of how the whole industry has had to suffer because of the offenses of a few who were never invited by us into our industry and whom we have no power to get rid of . . ."

The Roosevelt Administration spurred the lobby investigation when an executive order, issued from the White House this week, directed the Secretary of the Treasury to make available to the Senate committee all income, excess profit and capital stock tax returns to the extent necessary in the investigation of lobbying activities in connection with the so-called holding company bill or any other matter or proposal affecting legislation.

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R.E.A. Loans Sought by Forty-Six States

Private utilities and public bodies represented — Terms of loans same to all applicants — Authorizations soon to be made — Utility survey accepted

Forty-six states are represented in the applications for rural power and light projects to be built out of loans from the Rural Electrification Administration, Morris L. Cooke, administrator, announced last week. The greater number of applications has come from public bodies and farm co-operative organizations, although some of those made by private utility companies involve much longer lines and larger loans. While R.E.A. will make loans to all groups, public and private, on the same terms, it was announced that preference will be given to applications from public bodies.

"We have been gratified," Mr. Cooke said, "by the extremely wide geographical distribution of the applications for power and light projects and of the inquiries concerning proposed projects. Inquiries have come in rapidly and in large volume from every state in the Union. Forty-six of the states already are represented by projects pending. Authorizations of loans for the first of these projects will be made soon.

Plans for providing electricity within eighteen months to 351,000 rural prospects, including 247,000 farms, at a cost of about $238,249,000 were outlined this week by Morris L. Cooke, Rural Electrification Administrator. Based on a nation-wide survey undertaken by representatives of the private electric industry in May, a practical program submitted by them last week has been approved by Mr. Cooke. He stated that his organization was prepared to swing into action at once on the proposed use of $100,000,000 for the construction of electric-distribution lines in rural areas not now having power and light service. The industry's estimates totaled $113,685,000, but this figure may be somewhat reduced when all the operating companies, some of which

have not yet been approached, are included in the program.

House wiring, service extensions and electrical appliances loans will be made by the Electric Home and Farm Authority, which is separate from the R.E.A. administered by Mr. Cooke. When and on what terms the E.H.F.A. funds will be available to the prospective rural customers is undetermined.

Mr. Cooke continued: "The solution of our problem seems to lie in co-ordinating the efforts of all parties who can profit by the development of rural electrification, whether they profit through a financial return or through the comforts and economies of living, or through both."

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Sacramento Bond Issue Validated by Court

Sacramento won a major victory last week when Superior Judge J. O. Moncur of Plumas County issued an order validating a $12,000,000 bond issue voted last November. The bonds, voted by the citizens of the Sacramento Municipal Utility District, which includes all of Sacramento County and part of Placer County, are to be used for the financing of both a generating and distribution system. The project ties in with the Central Valley Water Project to which the federal government allocated $20,000,000 a few weeks ago.

The Pacific Gas & Electric Company appeared in opposition to the validation before Judge Moncur and an appeal from his decision to the state supreme court is anticipated.

Edison Institute Opens Fight on Government Power Program

McCarter says industry has been under attack for more than a year—Institute plans to contribute to costs of T.V.A. appeal—Reports on Wheeler-Rayburn expenditures

Resisting efforts to discredit the entire industry through the current investigation on lobbying in Washington, Thomas N. McCarter, president of the Edison Electric Institute, issued last week a statement, authorized by the institute's trustees, attacking governmental methods.

For a year or more, he pointed out, the electrical industry has been subjected to a most extensive political and governmental attack. Emphasizing that the institute is not a political organization but a trade association for the industry, a research and fact-finding body, Mr. McCarter pointed out that when the crisis resulting from the government moves became apparent, "believing the whole plan of the government to be *ultra vires*, the institute determined that it owed to its membership the obligation to test out these principles of constitutional law."

Mr. McCarter's statement disclosed that the institute spent $86,992 to support litigation with the T.V.A., which included $35,000 to Newton D. Baker and James M. Beck, constitutional lawyers, for an opinion on the constitutionality of the proposed government projects such as the T.V.A. The opinion was that such activities on the part of the government were unconstitutional. Mr. McCarter continued: "It (the institute) proposes further to participate in the cost of appealing this case to the Supreme Court of the United States so that a final judicial determination of the constitutional right of the federal government to expend its taxpayers' money in the destruction of the property of its taxpayers may be obtained, both as respects direct competition by the government, and loans and grants to municipalities for the purpose of achieving a like result.

Wheeler-Rayburn bill expenditures

"In connection with the Wheeler-Rayburn bill, the board of trustees in February adopted a resolution recommending that each company should present its own case on the Wheeler-Rayburn bill, and that the Edison Electric Institute should answer inquiries and furnish facts to member companies relating to the matter as might be desirable. The matter of generally conducting the opposition to the bill was left to the committee of public utility executives, of which Philip H. Gadsden is chairman. In order to aid this committee in its work, the institute later paid the law firms of Simpson, Thacher & Bartlett and Sullivan & Cromwell the sum of $75,000 each for their legal work rendered to the committee of public utility executives in connection with the proposed legislation. In addition thereto, the institute has spent $19,757 for official copies of transcript and government documents, printing, mimeographing and postage. All such expenditures have been audited by Price, Waterhouse & Company and the audit delivered to investigators of the Senate investigating committee, together with correspondence, letters, records and materials relating to the bill.

Institute policy stated

"The Associated Gas & Electric Company is not a member of the Edison Electric Institute. The policy which certain representatives of that company are alleged to have pursued does not meet with the approval of the institute. It has been the aim and policy of the institute that the whole opposition to these governmental activities and to this legislation which collectively threatened the very life of the industry should be carried on in an open and above-board manner."

AIRPLANE VIEW OF BONNEVILLE PROJECT

The river is crowded into one-half of its normal channel by the cofferdam jutting out from the northern side of Bradford Island. Cofferdams also isolate Bradford Slough (lower left). After power house and one-half of the main dam are constructed the river is allowed to flow through Bradford Slough while the remainder of the dam is completed.

Court Enjoins P.W.A. in T.V.A. Fight

District of Columbia Supreme Court upholds Alabama Power Company — Knoxville to appeal decision banning power plant — T.V.A. gets additional fund — Bill still in conference

On the petition of the Alabama Power Company a temporary court order restraining the Public Works Administration from making loans to four Alabama municipalities for the erection of transmission lines and distribution systems for handlng T.V.A. energy was signed last week by Justice Oscar R. Luhring of the District of Columbia Supreme Court. The utility, claiming to serve 65 out of the 67 counties in the state of Alabama with electric power, maintains that it has an investment of $150,000,000 in electric power plants in Alabama and all of the water-power projects have been undertaken under authority of an act of Congress or by permission of the Federal Power Commission. The four cities named in the petition are Decatur, Florence, Sheffield and Tuscumbia, all served by the company.

City of Knoxville has perfected an appeal to the Supreme Court of Tennessee from the decision of Chancellor A. E. Mitchell which temporarily enjoins the city from building a municipal electric distribution system, using T.V.A. power. In a decision handed down recently Chancellor Mitchell held that P.W.A. had no constitutional authority to loan funds to the city for a distribution system and the city had no constitutional right to enter into a contract with the T.V.A. for power. The chancellor held, however, that under acts of the 1935 Legislature the city had the constitutional right to build its own power distribution system through other financing.

Amendments adding $73,000,000 to the deficiency appropriation bill were approved by the Senate last week. Among the bigger amendments approved was an additional sum of $3,324,000 for the Tennessee Valley Authority.

The T.V.A. bill is still in conference, no definite action having been taken up to the present time.

•

Government Scores Point in New River Case

An order has been entered by Judge John Paul in the federal court at Lynchburg, Va., permitting the United States government to file a motion to strike out the Appalachian Electric Power Company's answer to an injunction suit filed against the utility seeking to restrain it from completing its New River hydroelectric power development until a federal license for its operation has been procured (ELECTRICAL WORLD, June 22, page 43). The order fixes the time and place of the hearing on September 19 in the courthouse at Harrisonburg, Va.

Leave is likewise granted the defendant to file a brief in opposition to the plaintiff's motion to strike out on or before September 6, and, in turn, the plaintiff is accorded the right to respond to the utility's brief before the day set for argument.

If the Appalachian's answer to the injunction petition is not stricken out by Judge Paul, the trial of the injunction suit will be held in Lynchburg at the December term of the federal court.

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Missouri Utility Loses Table Rock License

Having failed to respond to an order to show cause why its license should not be canceled, the Empire District Electric Company, which held priority on a water-power site on the White River at Table Rock, Mo., for more than twelve years, has lost its license. The company had failed to start construction on December 1, 1934, as provided for in the license. Denied a two-year extension of time by the commission (ELECTRICAL WORLD, June 22, page 42), the company failed to respond to an order to show cause by July 15 why its license should not be canceled.

The Empire District Company's plans called for an expenditure of $16,000,000 on the Table Rock project and an additional $14,000,000 for transmission lines and other facilities. The power commission ruled, however, that the company offered no substantial evidence of its good faith, intention or financial ability to construct the project.

•

Bonneville Bill Introduced; Johnson Bill Vote Expected

Senators McNary and Steiwer of Oregon jointly introduced this week a bill to provide for operation of the $50,000,000 Bonneville power project.

Under the terms of the bill the Secretary of War and Chief of Engineers are given authority to complete and operate the project and develop power to the economic maximum and to sell surplus power wholesale and buy or build the necessary wholesale distribution system and contract for interconnection and condemn property. The Federal Power Commission is given the authority to determine wholesale rates to be charged on the basis of cost plus amortization in 50 years of part cost of the project chargeable to power production. The commission shall also determine the accounting system and advise the Secretary on the extent of development and void wholesale contracts if retail rates are excessive.

Oregon and Washington each gets 18¾ per cent of any excess revenue above cost plus amortization. Public agencies will be favored over private in allocation of power.

President Roosevelt has requested "early and favorable consideration" of the bill. The President's request for action on the Johnson bill validating Parker Dam and other water-control projects affected by the U. S. Supreme Court's decision in litigation between the federal government and the State of Arizona (ELECTRICAL WORLD, May 11, page 47) is expected to bring the bill out of the House rules committee to a vote on the floor without further delay. The President said on July 26 that he had requested Representative O'Connor, the chairman, to act on the bill, which has been held up in the committee for several weeks.

•

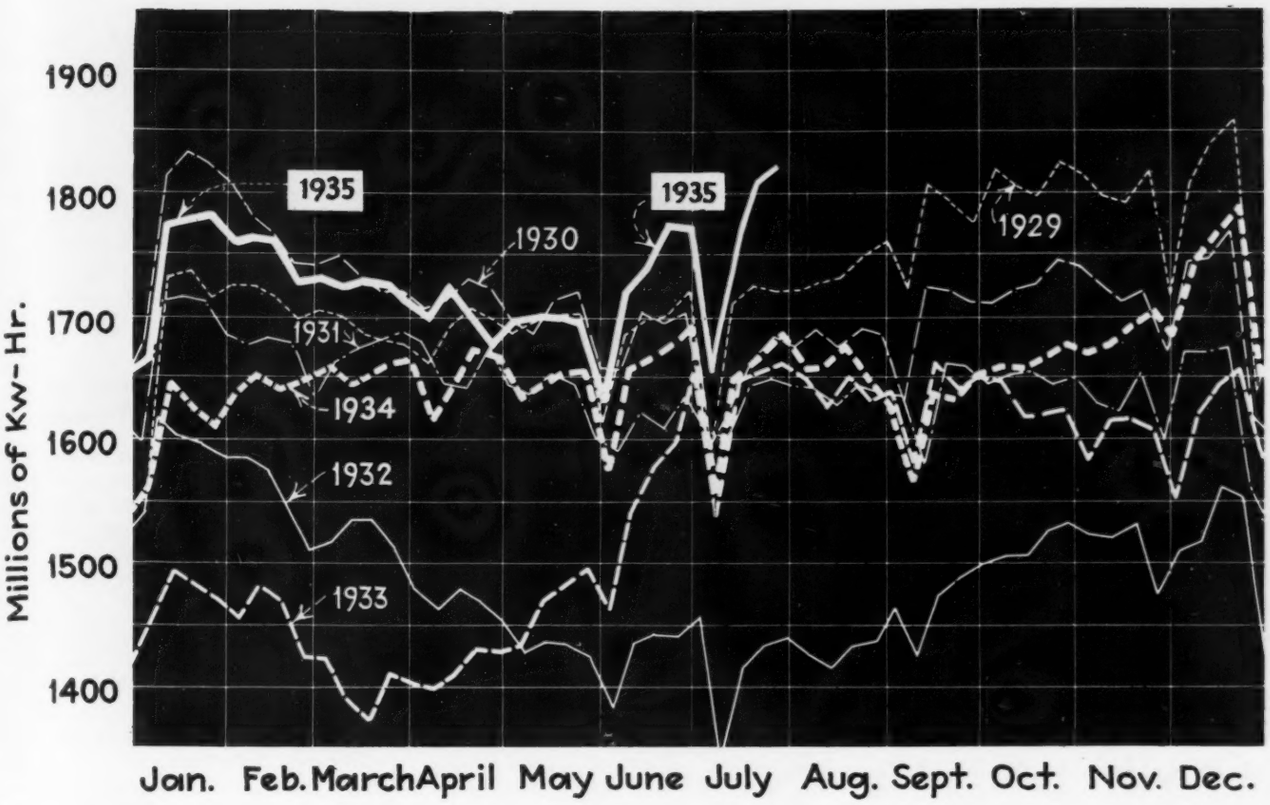
Utilities Concert to Fight P.W.A., Ickes Charges

Charges that a concerted attack by utility companies to prevent the construction of municipal power projects voted by various communities with financing through P.W.A. loans and grants were made last week by Public Works Administrator Harold L. Ickes. Twenty-two court actions have been filed, according to Mr. Ickes. The administrator's announcement was based upon a review of the litigation by Henry T. Hunt, general counsel of the Public Works Administration.

In virtually every case, the announcement stated, the language in the bills is similar in so far as questions of constitutionality are concerned. In some instances it is identical. "In a number of the bills the allegations of unconstitutionality are identical, indicating that they are drafted on forms or instructions emanating from some central source," Mr. Hunt reported.

Of the 22 bills filed attacking the constitutionality of Title II of the Recovery Act, eighteen were in federal courts and four in state courts, according to the report. "On motion of the government, nine bills have been dismissed; in three cases motions to dismiss have been denied; nine motions to dismiss are pending and one case (Middlesboro, Ky.) the Kentucky Court of Appeals allowed an injunction on the ground that the bond ordinance was subject to referendum. The Hunt report states that the total number of P.W.A. loans and grants to finance competitive municipal facilities is 31. Thus it appears that all such loans and grants have been attacked by the utility companies except nine."

Output Near All-Time Record



Electric energy production has been rising so rapidly during the past two months that it now challenges comparison with previous midwinter records. Summer output figures of other years have been consistently exceeded. During the week ended July 27 the electric light and power industry generated 1,823,521,000 kw.-hr., or 8.3 per cent more than in the corresponding week last year, according to the Edison Electric Institute. This beats the previous record for the week, in 1929, by 5.8 per cent.

Production of 1,807,037,000 kw.-hr. in the week of July 20 had established a new high point for 1935 by overshooting last winter's peak. This has in turn been surpassed by nearly 16,500,000 kw.-hr. The latest figure is within 2 per cent of the all-time maximum. It has been exceeded only in the three highest weeks of the winter of 1929-30 and, by a very narrow margin, in one week, in the autumn of 1929.

Regional gains over 1934 appear in every section of the country, the most striking being in the metal-mining Rocky Mountain division.

Weekly Output, Millions of Kw.-Hr.

1935		1934		1933	
July 27	1,824	July 28	1,684	July 29	1,662
July 20	1,817	July 21	1,664	July 22	1,654
July 13	1,766	July 14	1,648	July 15	1,648
July 6	1,655	July 7	1,556	July 8	1,539
June 29	1,772	June 30	1,688	July 1	1,656
June 22	1,775	June 23	1,675	June 24	1,598

Per Cent Change from Previous Year

Region	Week ended July 27	July 20	July 13
New England	+ 6.7	+ 8.3	+ 7.1
Middle Atlantic	+ 8.5	+ 9.3	+ 8.7
Central Industrial	+ 7.2	+ 6.5	+ 6.3
West Central	+ 9.3	+ 7.3	+ 9.2
Southern States	+ 7.6	+ 7.4	+ 8.6
Rocky Mountain	+33.7	+31.4	+25.0
Pacific Coast	+ 5.4	+ 7.3	— 0.4
United States	+ 8.3	+ 8.6	+ 7.2

Alabama Power Loses Suit on Mitchell Dam Costs

Authority of the Federal Power Commission to control the capital structure and accounting of its licensees was decisively upheld in a decision handed down July 17 by Justice Bailey of the Supreme Court of the District of Columbia, which also upheld the principles used in the commission's cost determinations. The case in question was instituted by the Alabama Power Company, a subsidiary of the Commonwealth & Southern Corporation, in reference to the company's Mitchell Dam project on the Coosa River in Alabama. It challenged the commission's order of June 30, 1932, setting the cost of this project at $6,173,576.82, which was $4,472,479.94 less than the amount claimed by the company as the actual legitimate cost. The principal item in controversy was the claim of $3,500,000 for land, which the commission reduced to $76,135. The suit also challenged a section of the order requiring the company to set up its accounts in accordance with the commission's regulations.

In handing down his decision Justice Bailey cited the ruling of the United States Supreme Court in the case of the Clarion River Power Company, holding that the power commission had the right to determine original costs. Maintaining that the commission had not acted arbitrarily, Justice Bailey said: "Apparently the only loss to the defendant that may result from the order of the commission is the cost of keeping books in the manner prescribed by the commission. The plaintiff voluntarily accepted a license from the government and is bound by its conditions. The bill should be dismissed with costs."

•

Gasconade Plan Abandoned

Plans of the Gasconade River Power Company to build an $11,000,000 hydroelectric dam and power plant on the Gasconade River, near Arlington, Mo., have been abandoned. The company, with approval of the Federal Power Commission, has withdrawn its application for a construction permit.

Court Appoints Trustees for Clarke Holding Company

Federal Judge William H. Holly of Chicago has appointed Irwin T. Gilruth, an attorney, and former Judge Charles A. McDonald as temporary trustees for the Public Utility Securities Corporation, key holding company of the Harley L. Clarke utility system, which is undergoing reorganization under section 77b of the Bankruptcy Act.

Control of the holding company was recently transferred from the Reconstruction Finance Corporation to the Atlas Corporation, big Eastern investment trust (ELECTRICAL WORLD, July 20, page 47). The Continental Illinois National Bank, which also held a block of notes of the company, has disposed of its holdings to Atlas.

Stockholders of the Utilities Power & Light Corporation, which is controlled by the Public Utility Securities Corporation, meeting on July 24 in Richmond for the second time in four weeks, failed to elect directors and adjourned to August 21, because a quorum of stock was not represented.

•

Pasadena Announces Frequency Changeover

In the near future the Light and Power Department of the City of Pasadena will change the frequency of the electrical energy supplied from 50 cycles to 60 cycles. A survey of electrical equipment, which will need adjustment because of this changeover, has been started by the Municipal Light and Power Department. Questionnaires are being sent out to all consumers, according to B. F. Delanty, general manager of the department.

•

Jersey Utility Calls $65,000,000 Bond Issues

Public Service Electric & Gas Company has called for redemption on October 1 two bond issues aggregating $65,000,000. Issuance of a similar amount of first mortgage refunding bonds, 3½ per cent series, for retiring these two 4½ per cent issues has been authorized by the New Jersey State Board of Public Utility Commissioners upon application of the utility.

•

Middle West Hearings Postponed

Further hearings on a plan for reorganization of Middle West Utilities Company were postponed until September 12 by Federal Judge James H. Wilkerson after receipt of a report on Kentucky Utilities Company, one of its subsidiaries. In his report, Walter A. Shaw, adviser to the court, noted several potential sources of increased revenue and stated that "prospects for economical operation in 1935 are excellent." Among the companies on which reports are to be made on September 12 are Central Illinois Public Service Company and Kansas Electric Power Company.

•

Standard Gas & Electric Plans Extension of Notes

Standard Gas & Electric Company has mailed to the known holders of its $14,823,000 twenty-year 6 per cent gold notes and its $9,826,500 6 per cent convertible gold notes, both due October 1, 1935, a prospectus relative to a plan for the extension to October 1, 1940, of the time for the payment of the principal of these notes. The plan of extension as outlined in the prospectus provides that the rate of interest shall continue at 6 per cent.

•

Maytag Gets Injunction Against Brooklyn Edison

In a case involving infringement of patent, Maytag Company was granted last week an injunction by Judge Mortimer W. Byers in federal district court in New York against the Brooklyn Edison Company, Inc., distributor of the "Easy" and "ABC" washing machines. Judge Byers ruled that a comparison of the Maytag machine and those said to infringe showed unmistakably that there was no fundamental difference between them and that the mechanism and mode of operation were in such close resemblance that "the issue of infringement presented no problems."

COMING MEETINGS

American Foundrymen's Association—Annual convention, Toronto, Canada, August 20-23.

American Institute of Electrical Engineers—Pacific Coast convention, Seattle, Wash., August 27-30. Great Lakes District meeting, Purdue University, West Lafayette, Ind., October 24-25, H. H. Henline, national secretary, 33 West 39th Street, New York.

Illuminating Engineering Society—Annual meeting, Hotel Netherland Plaza, Cincinnati, Ohio, September 3-6. D. W. Atwater, general secretary, 29 West 39th Street, New York.

National Electrical and Radio Exposition — Grand Central Palace, New York, N. Y., September 18-28.

Electrochemical Society—Fall meeting, Washington, D. C., October 10-12. Colin G. Fink, secretary, Columbia University, New York.

National Association of Railroad and Utilities Commissioners—Annual convention, Nashville, N. C., October 15-18. John E. Benton, general solicitor, 806 Earle Building, Washington, D. C.

National Electrical Wholesalers' Association—Annual convention, Chicago, Ill., October 14-18. E. Donald Tolles, managing director, 165 Broadway, New York.

Santee-Cooper Project Submitted to Court Test

Action has been started in the South Carolina State Supreme Court at Columbia by Frank K. Clark of Sumter County on behalf of taxpayers to test the validity of the 1934 South Carolina legislative act creating a state authority to develop the proposed $37,000,000 Santee-Cooper power and navigation project. The proposed project was recently approved by President Roosevelt, but the granting of P.W.A. funds was conditioned upon the constitutionality of the South Carolina Public Service Authority created by the state Legislature.

•

Consolidated Rate Schedule Approved; Merger Allowed

Formal approval was given by the New York Public Service Commission this week to the new electric light and power schedules of the Consolidated Gas System, estimated to save consumers in New York City approximately $7,000,000 a year. At the same time the commission adopted an order approving under certain conditions a merger of the New York Edison Company and the United Electric Light & Power Company into a new corporation to be known as the New York Edison Company, Inc. The new company will file new rates, similar to those approved, within a few days. The new rates became effective August 1.

The total reductions will be made up of $3,615,000 savings for residential consumers, $2,575,000 for retail commercial and other general users and the remainder in adjustments in wholesale rates and revision of the coal adjustment charges.

The new schedules provide that the submetering of electricity shall be entirely prohibited under the residential rates. A provision under the new retail commercial rates has been modified to meet commission objections so that not only hotels and rooming houses, but all landlords will be allowed to furnish electricity with rent. In other service classifications the submetering provisions remain substantially as at present.

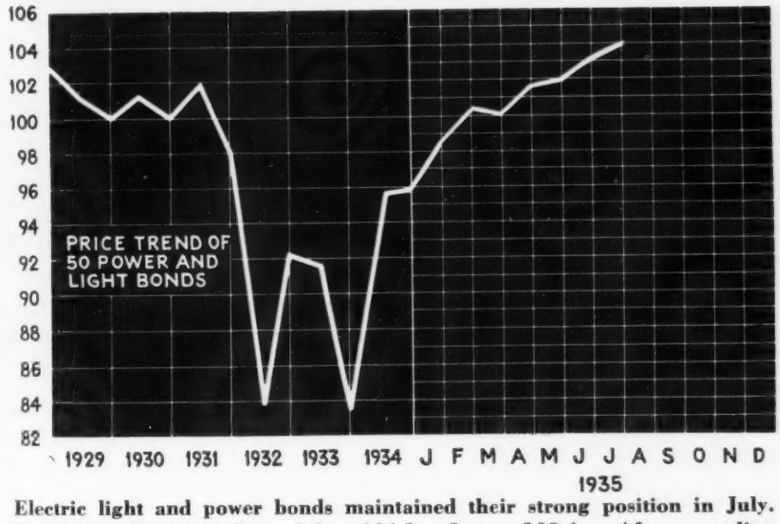
In dealing with the merger of the New York Edison and United companies, Mr. Maltbie insisted that savings brought about by the consolidation should be passed on in part to the consumers. It is contended that this will be somewhat achieved when the combined company files its new rate schedules.

•

Rate Survey Completed

With the issuance of reports last week covering the states of New York and Pennsylvania, the Federal Power Commission has completed the electric rate survey of the 48 individual states.

Utility Bonds Make Further Gains



Electric light and power bonds maintained their strong position in July. *Electrical World* index, July, 104.1; June, 103.4. After receding slightly last week, stocks recovered this week. *Electrical World* index, 27.2; last week, 26.0.

Crocker-Wheeler Reports $19,975 Net Profit

For the six months ended June 30 net profit of the Crocker-Wheeler Electric Manufacturing Company after federal taxes, depreciation, amortization and other charges totaled $19,975, equal to 7 cents a share on 290,500 no-par common shares, contrasted with net loss of $16,641 last year. Bookings for the first and second quarters, the company stated, were at practically the same rate and the total for the six months was 37 per cent above the corresponding period in 1934.

•

Cutler-Hammer Profit Rises

For the six months ended June 30, 1935, Cutler-Hammer, Inc., reports net profit, after taxes, depreciation and other charges, totaling $221,438, equal to 67 cents a share on 329,600 shares, compared with $105,489, or 32 cents a share, in the 1934 half. The company was recently awarded a $225,000 contract by the Great Lakes Steel Corporation for auxiliary controls, limit switches, clutches, safety switches and crane control equipment for the new continuous hot sheet strip mill and the cold mill being built by the steel corporation.

•

Kelvinator Earns 68 Cents

For the nine months ended June 30 Kelvinator Corporation reports net profit after depreciation, interest, federal taxes and other charges of $778,583, equal to 68 cents a share on 1,147,107 shares of no-par common stock, compared with $1,212,421, or $1.09 a share, on 1,108,818 shares in the similar period of last year. For the quarter ended June 30 net profit amounted to $711,608, equal to 62 cents a share on 1,147,107 common shares, compared with $357,297, or 32 cents a share, on 1,110,068 shares in preceding quarter and $1,248,839, or $1.12 a share, on 1,108,818 shares in the second quarter of previous year.

These figures do not include earnings of Refrigerator Discount Corporation, a wholly owned subsidiary, whose profits are customarily taken as a dividend at close of fiscal year on September 30.

•

General Electric to Equip 75 Air-Conditioned Homes

The trend to air conditioning which has been so heavily established in Washington, D. C., largely through the example and activities of the United States Government, is now extending to home construction in the capital. The General Electric Air Conditioning Institute announces as the latest development in that field a building program inaugurated by one of Washington's outstanding home developers, in which at least 75 houses will be air conditioned.

The 75 houses will be built by Waverly Taylor, Inc., architects and builders, who have developed some of Washington's most interesting home projects in recent years. Specially designed General Electric air-conditioning systems will be used exclusively in the 75 houses, which will have as standard equipment year-around air-conditioning systems, with the exception of the compressor used to supply refrigeration for summer cooling and dehumidifying. All other equipment necessary for summer conditioning is included in the special central system. Installations will be made by the Hudson Air Conditioning Corporation of Washington.

Several houses in the three developments to be undertaken have been selected by the Washington committee of the New American Home building program as General Electric New American model homes. Ground for the first of these was broken in Rollingwood on June 15, in connection with the nationwide observance of Better Housing Day. The New American Home movement was initiated by the General Electric Company, which is co-operating with local building committees throughout the country in erecting a modern model home for every 100,000 of population.

New York Metal Prices

	July 16, 1935 Cents per Pound	July 31, 1935 Cents per Pound
Copper, electrolytic	8.00*	8.00*
Lead, Am. S. & R. Price	4.15	4.15
Antimony	12.50	12.50
Nickel ingot	35.00	35.00
Zinc, spot	4.675	4.775
Tin Straits	52.25	52.70
Aluminum, 99 per cent	19—21	19—21

*Delivered Connecticut Valley

General Electric Forms Housing Unit

Separate company, Houses, Incorporated, organized to encourage home-building — Announcement made by Swope and Young — C. E. Wilson, chairman

For the prime purpose of co-operating in the encouragement of house-building of all worthy types, the General Electric Company has organized a separate company, known as Houses, Incorporated, it was announced this week in a joint statement by Gerard Swope, president, and Owen D. Young, chairman of the board of General Electric. It will be the purpose of Houses, Incorporated, to co-operate with others in the development of houses of any type which seems worthy and promising; to conduct research work, and to assist in the management and financing of such enterprises.

Charles E. Wilson, vice-president of the General Electric Company, will be chairman of the board of the new enterprise; Foster Gunnison, who has been associated with Houses, Incorporated, since its inception, will be president. Offices will be located in the General Electric Building, 570 Lexington Avenue, New York.

Since it is primarily concerned with the interior mechanism of the house, the General Electric Company has not been, nor will Houses, Incorporated, be, the proponent of any particular type of construction inclosure, it was announced, whether it be pre-fabricated, partly pre-fabricated or the traditional inclosure.

"Houses, Incorporated, will not itself engage in the construction or sale of houses," the statement by Messrs. Young and Swope declared. "It will undertake to help others in worthy projects and to carry on fundamental work and experiments for the particular benefit of those interested in perfecting modern houses. Only by such experimentation and effort in the construction of small homes can their quality and convenience be improved and their cost diminished so as to bring them within the purchasing power of greater numbers of people."

"The General Electric Company," the statement continues, "is endeavoring to make its contribution by developing and standardizing the operating mechanism of the modern home, such as heating, air conditioning, lighting, cooking and refrigerating appliances, dishwashers, laundry machinery, radios, and clocks, and through volume production and installation substantially reducing the cost and increasing efficiency. The market for such standardized units must, however, depend upon the development of a large housing program throughout the nation, and to aid and stimulate such a program, Houses, Incorporated, has been formed."

•

Allis-Chalmers Report Shows Substantial Gains

Allis-Chalmers Manufacturing Company reports, for the second quarter of 1935, a net profit of $577,197, after all charges, including debenture interest, depreciation and federal taxes, on billings of $9,672,770. This compares with a loss in similar quarter of 1934 of $145,100 on billings totaling $5,207,870.

Bookings for the second quarter amounted to $10,160,026, an increase of 70 per cent over the $5,982,212 reported in the same 1934 quarter. Unfilled orders June 30, 1935, aggregated $8,669,549, compared with $8,499,613 on the same date a year ago, and $8,013,859 on December 31, 1934.

For the six months ended June 30 orders booked totaled $17,026,107, compared with $10,579,868 in 1934; net sales billed amounted to $16,370,416, compared with $8,506,253 the preceding year, and net profit totaled $554,955, against a loss of $822,253 for the similar period of 1934.

•

Westinghouse Sales Increase 38 per Cent

Orders received by the Westinghouse Electric & Manufacturing Company during the first six months of this year were 21 per cent higher than during the first half of 1934 and for the second quarter were the highest since the second quarter of 1931. Sales billed during the first six months were 38 per cent higher than for the same period last year:

	Quarter Ended June 30, 1935	Quarter Ended June 30, 1934
Orders received	$34,222,014	$33,655,022
Sales billed	36,083,215	27,287,545
Net profit	3,938,692	1,744,427
	Six Months Ended June 30, 1935	**Six Months Ended June 30, 1934**
Orders received	$64,984,915	$53,892,610
Sales billed	62,296,017	45,281,590
Net profit	6,265,188	* 31,725

* Net Loss

Referring to the proposals of the federal government to impose greater taxes on "big business," the statement comments as follows:

"Your company is owned by 48,734 stockholders, of which 41,399 stockholders own less than 100 shares of stock each. With such a wide distribution of the stock among so many owners, it may readily be seen that imposing the tax on a graduated basis does not necessarily accomplish the purpose of taxing 'bigness,' but will curtail the payment of dividends and severely penalize the small as well as the large stockholders.

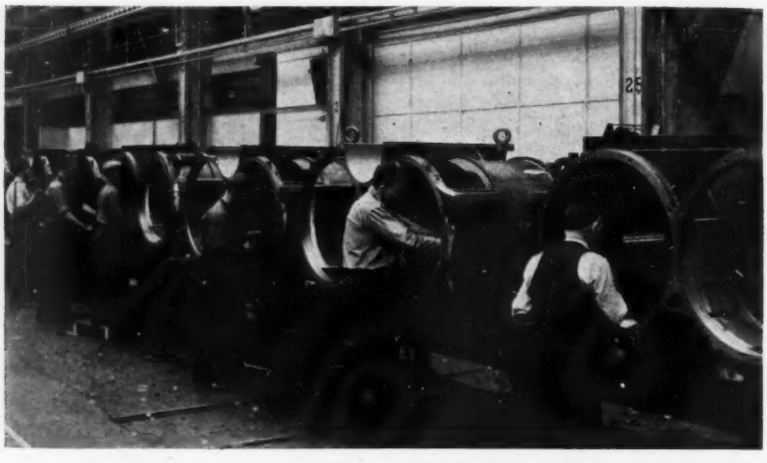
"The management of this company believes it has a duty to all of its stockholders to call attention to the constant increase in the tax burden, and especially this discriminating unsound proposal of a graduated income tax for corporations."

•

$6,900,000 Electrical Exports

Exports of electrical equipment during the month of May were valued at $6,902,103, according to an advance report issued by the Electrical Division, Department of Commerce. The report gives details by commodities and by countries. Leading customers were Canada $845,456, United Kingdom $699,360, Brazil $372,262, South Africa $359,282, Argentina $335,899, Mexico $333,682, France $332,525, Cuba $261,812, Spain $237,753.

DOUBLE MOTORS FOR P. R.R. LOCOMOTIVES



These "twin motor" frames will be part of the motive power to drive the most powerful electric locomotives in this country. They are being built by the Westinghouse Electric & Manufacturing Company for the Pennsylvania Railroad for service on the main line between New York and Washington. Six of these twin motors, totaling 4,620 hp., will be used on each of the 57 locomotives now under construction.

What PYRANOL Means To Users of CAPACITORS

Approved by Underwriters

PYRANOL is General Electric's trade name for the nonexplosive, nonflammable liquid dielectric now used in all G-E capacitors. It has received the unqualified approval of the National Board of Fire Underwriters as a result of recent laboratory tests.

99.87% Perfect in Service

PYRANOL capacitors have made a remarkable record. Reported electrical failures amount to less than 0.13 per cent—a service record more than 99.87 per cent perfect.

Savings in Space

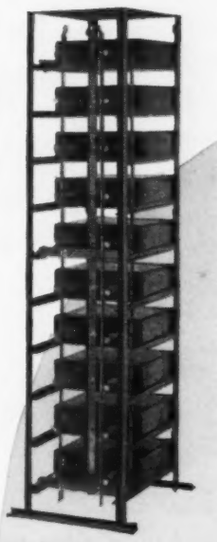
PYRANOL, because of its superior dielectric characteristics, has made possible great savings in space. Ever since its use was introduced, in 1931, the size of G-E capacitors has steadily decreased, until now some ratings are as much as 75-per-cent smaller than the corresponding capacitors of five years ago.

Accepted by Industry

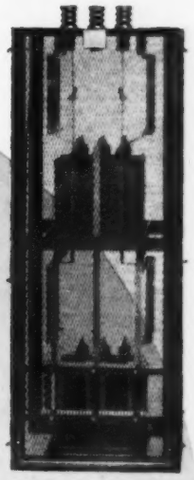
PYRANOL capacitors are now being purchased at the rate of thousands of kv-a. each year by industrial users of power because they save money through power-factor improvement. Power companies, also, are using them more and more as a simple and economical means of increasing the capacity of generators and feeders.

Ask your G-E representative for a copy of our new Bulletin GEA-771I, "Improving Power-factor for Profit," or write General Electric, Dept. 6A-201, Schenectady, N. Y.

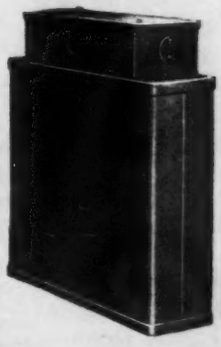
PYRANOL



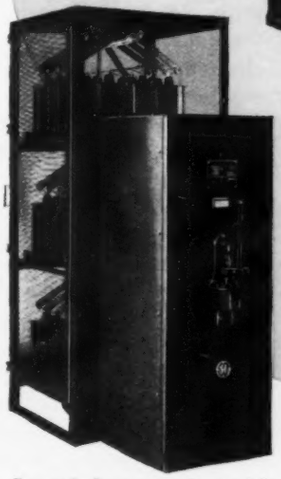
Small indoor low-voltage equipment, with screen removed to show unit arrangement



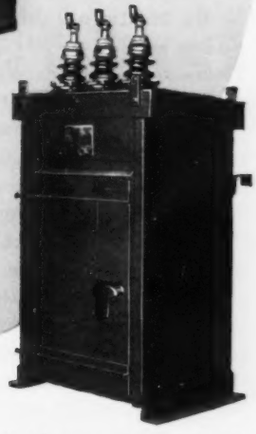
Small indoor equipment for primary circuits in substations and industrial plants



Enclosed, box-type capacitor unit for individual motor applications



Large indoor capacitor, with oil circuit breaker completely enclosed in steel cubicle



Outdoor capacitor suitable for either crossarm suspension or base mounting

A complete line of G-E Pyranol capacitors for power-factor improvement

360-109

GENERAL ELECTRIC

Mass Production in Meter Changes

Changing to outdoor metering in a well-organized program* is now under way in Detroit. Something over 40,000 of the 450,000 residence meters on the Detroit Edison system are now of the outdoor type. About half of these are to be classified as of modern design, having been made since the incorporation of the new sequence idea in metering.

As the result of an agreement between employers and electrical workers a definite labor cost of two man-hours at $1.25 per hour for each meter changed was chosen. On this base, and with the addition of the unit material cost per average job, a flat price of $5.50 per change was agreed upon by the contractors and the utility. This work is providing steady employment for 60 to 75 wiremen at a time when very little new work is available.

Work orders for changes are issued by the utility to individual contractors in lots of 200 to 400 meter locations. The orders are carefully routed so that no time is lost between jobs. Arrangements for each particular job are made by the utility's field supervisor, who at the same time spots the exact location for new outdoor installations. The supervisor works immediately ahead of the contractor's crew and just behind them comes a utility meter installer. The contractor's men work in crews of six, two men on each job. The working day is seven hours, giving a total of 42 man-hours, and allowing 21 meter changes per day per crew.

Under the guaranteed job production plan which was worked out with labor, each contractor is obligated to supply his crews with ample quantities of all necessary materials and tools so as to avoid standby or non-productive time. Separate job lists are not kept. Instead, a materials summary is made in the office after the completion of an entire district. This may include some 200 to 400 changes and it reflects the total amount of material charged out, less the inventory of unused materials upon completion of the district. From this summary it is possible to compute average costs per meter change.

Most of the contractors engaged in this work have developed portable supply outfits to carry tools and necessary materials. They do not furnish the outdoor meter housings. Existing materials are reused if in good condition except for new service wires. Nothing smaller than No. 8 wire is installed up to the outdoor meter housing. Old wires may be reused between the new meter and former meter location. The contractor is required to replace defective service switches, corroded conduits and deteriorated service wire when so ordered by the utility field supervisor. On simple installations having only one meter the meter housing is cut into the existing service conduit if it is of ¾-in. pipe. However, in many cases the new location of meter housings requires the rerouting of conduit and an increased amount of material.

The McCleary-Harmon Electric Company developed this trailer-mounted stock and tool-storage house as a portable base for crews making outdoor meter installations at a cost of less than $100. Some other contractors have equipped special trucks, but the trailer design appears to be more economical because the investment is lower and such expenses as automobile insurance, motor upkeep, taxes and licenses are eliminated or reduced. A three-day supply of materials for six men can be carried in this trailer. It has a storage compartment which will accommodate about 1,500 ft. of assorted sizes of conduits. A ladder is kept on the roof.

Job trailer for meter changes

A summary of 1,600 installations completed by one Detroit firm shows the average quantity for three principal items of material furnished: 18,000 ft. No. 8 rubber-covered and bare wire, 11.2 ft. per meter; 45,400 ft. No. 10 rubber-covered wire, 24.4 ft. per meter; 9,580 ft. ¾-in. steel tubing, 6 ft. per meter.

•

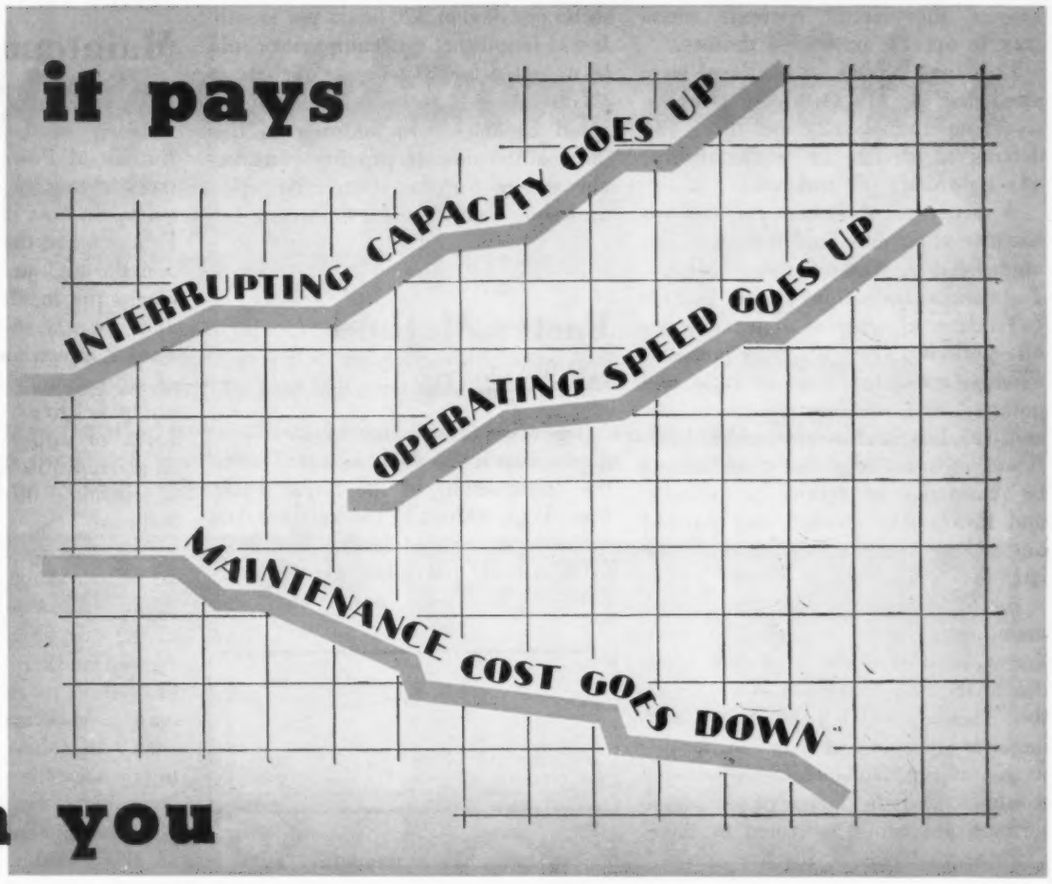
Causes of Transformer Failures

Causes of failures of distribution transformers and measures taken to reduce them were discussed recently before a New York group of engineers by A. H. Rapport and T. D. Reimers, New York Edison Company.

Analysis during the five years 1930 to 1935 show that winding failures were responsible for 66 per cent of the transformer outages. Bushing failures accounted for 27 per cent and auxiliary equipment for the remaining 7 per cent. Faults in the primary windings were responsible for 60 per cent of the failures of transformers in service. Initial failure occurring here usually results in carbonization of the oil, causing subsequent failure in other elements of the equipment. The

*The program was described by O. E. Hauser in the article "Twenty Years of Outdoor Metering," published in ELECTRICAL WORLD, July 14, 1934. In this article Mr. Hauser stated that "the program is being carried out on a contracted price per installation with several electrical contractors."

How it pays



when you modernize your G-E breakers by adding oil-blast

BREAKER modernization pays for itself in savings—savings that are difficult to figure but very real nevertheless. The addition of oil-blast pays in greater security—assurance that, even with more and more generating capacity being utilized, your old breakers will provide adequate protection.

So, be on the safe side; be assured of low-cost system operation by modernizing your old G-E breakers. Their arcing time will then be greatly reduced, resulting in:

Less damage to apparatus and cables, because the fault current is of short duration

Improved system stability, because rapid clearing of faults is one of the important factors in maintaining load

Better service, because speedy interruption of fault current permits immediate restoration of power

Moreover, oil-blast decreases maintenance because with it you have less burning of contacts and less carbonizing of oil. Let us point out just what advantages *you* will get by modernizing *your* breakers. General Electric, Schenectady, N. Y.

810-57

GENERAL ELECTRIC

secondary faults usually cause the heavier short-circuit currents necessary to operate protective devices.

Principal causes of failure were attributed to: (1) Overload or excessive temperature; (2) moisture; (3) defects of design or workmanship; (4) lightning; (5) unknown.

A program of systematic and exhaustive shop and field tests was recommended to reduce these failures. Tests and examinations should include (a) taking of samples of transformer oil periodically, (b) high-potential winding tests, (c) tests of ratio and polarity, (d) winding-resistance tests and (e) temperature-rise under load. It was recommended that transformers be removed from service periodically and thoroughly cleaned and painted and where necessary oil should be changed or filtered.

Failures due to faulty methods of manufacture were reported to have decreased during the past few years due to improved methods of testing in the factory. High-frequency test methods are being used to aid the detection of metallic inclusions between windings and in some cases transformers are being subjected to three times normal voltage for five minutes before being released, it was declared.

•

Derrick Operation Steam Cost

By F. A. WESTBROOK
Consulting Engineer,
Center Conway, N. H.

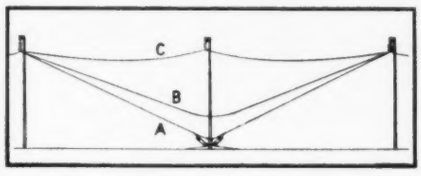
The Maine & New Hampshire Granite Company has recently conducted tests on the relative costs of operating electric and steam hoists for derricks in its quarry at Redstone, N. H. Until the spring of 1934 all hoisting machinery was steam operated. Each derrick had its individual steam engine and boiler located in separate houses at convenient points. Due to increased business during the past summer it was necessary to install an additional derrick and hoisting equipment and the electrically driven machinery was installed at that time. This consists of a standard three-drum hoist driven by a 75-hp., three-phase, 220-volt induction motor. This is a G.E. slip-ring motor with grid controller. A 10-hp. induction motor, type MR, is used for the swing of the derrick and is provided with an a.c. cam switch.

This was tried out over a period of three months, operating for eight-hour shifts per day, or 320 hours per month. It was found that this equipment could be operated for 40 per cent of the cost of operating a steam-driven hoist of equal capacity. In addition to this the maintenance is proving considerably lower for the electrically operated equipment than for the steam.

•

Faster Method of Sagging

To string 150 miles of three-conductor line in 25 days, as was done in the construction of the Great Falls-Fort Peck (Mont.) 154-kv. line last summer, means that few opportunities to save time and labor can be overlooked. One such opportunity was discovered in the sagging of the conductor. Usual practice is to sag a section of line and hold the conductors with temporary guys until sag is established in the next section. The strains then being equalized on both sides of the temporary guys, they can be removed and carried along to a holding point ahead.



Sagging without temporary guys

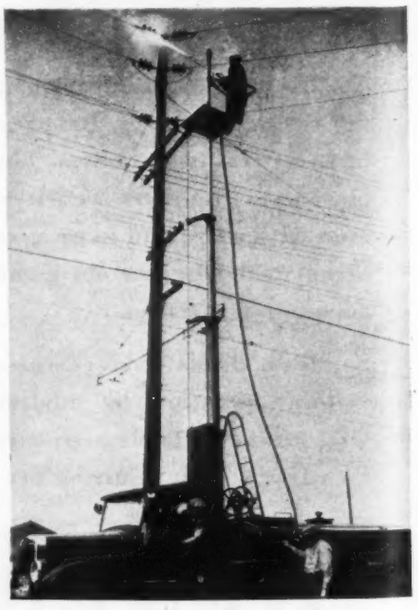
Position "A" shows conductor when sagging strains have been equalized on the two sides of the center point. The curve of the conductor when the grips have been released is shown by "B" and the normal spans by "C."

But sagging was not done this way on the Great Falls-Fort Peck line. No temporary guys or anchors were installed. The method used is indicated in the accompanying sketch. At the end of the section being sagged the conductor is brought down to the base of the next structure, against which the sagging pull is made. Proper tension being applied here, the next section is then pulled up, equalizing the strain at this point. The grips are then loosened and the wire hangs in a double span length at the proper tension. Raising the conductor to the structure in the middle of this double span makes two normal spans and changes the conductor tension very little, not enough to matter greatly.

Aids Insulator Maintenance

To save time and lower the cost of washing insulators the Los Angeles Bureau of Power and Light uses the truck shown in the metropolitan and suburban area of Los Angeles County. Features are the telescoping platform and the high-pressure water jet which cleans the insulator string thoroughly and quickly. According to T. A. Panter, electrical engineer in charge of operation, the equipment is used on pole lines operating at 33,000 volts, or approximately 19,000 volts to ground. In describing this method of cleaning insulators he reports as follows:

"No attempt is made to wash insulators while energized. However, on double-circuit pole lines, the line next to the one being washed remains energized and care is exercised in using the nozzle to avoid winds that would tend to blow spray into the energized line. Patrolmen handling the spray nozzle take the precaution of being at least 15 ft. from any energized line. No effort is made to ground the nozzle as this would be a rather difficult thing to do on account of very uncertain ground resistance in this locality. Considerable care is taken to clean the under portion of the insulators quite thoroughly at least every 90 days and the average pump pressure amounts to approximately 325 lb."



Special truck used for cleaning insulators

Pump press, supplied with water at 325 lb., washes insulators to stop radio interference.

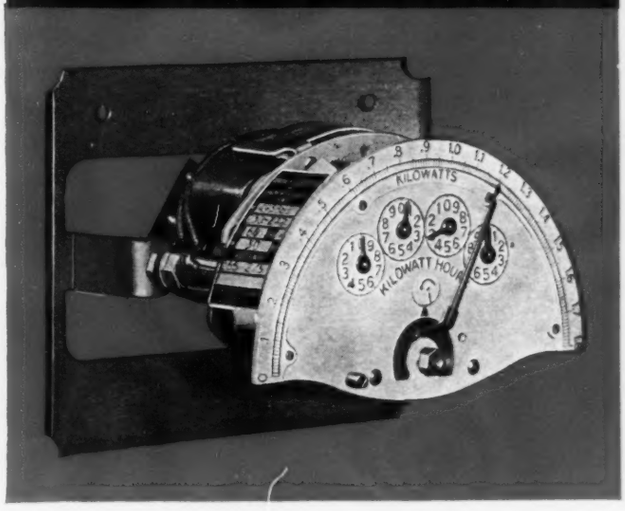
Changing conditions call for MODERN Meters

Loads—both domestic and commercial—are building up steadily. And conditions point to a further increase. Now is the time to determine if you are getting maximum benefit from these added loads. To do this—look to your meters. They must register accurately.

Watthour meters and demand meters of today are definitely superior to earlier types. They are built to meet modern conditions. Investigate them. A systematic program for the retirement of obsolete meters may prove a sound investment.

WATTHOUR METER, G-E TYPE I-20

DEMAND REGISTER, G-E TYPE M-20



THE MODERN G-E watthour meters are known as Types I-20A, I-20B, I-20C, and I-20S. They are all fundamentally the same, differing only in the method of mounting.

In their design, stress was laid on obtaining a high degree of accuracy under all conditions of service. They have practically straight-line accuracy up to 300-percent load—a feature which insures correct registration from light loads to the heavy loads taken by present-day residential consumers.

They have high torque, which gives sustained accuracy for long periods of time. Their performance is but little affected by variations in voltage, frequency, wave form or temperature. The I-20's are *modern* meters.

THE G-E Type M-20 demand register has now rounded out a full year's service. Favorable reports from many users, and the large number of repeat orders, are indicative of the widespread acceptance of this new register. It has proved its accuracy—and above all, its dependability.

Other advantages are now being offered. One is a new packing bracket, illustrated above. This gives added assurance that every register will arrive in good condition. It also makes the register easier to inspect and gives added protection while handling. This new bracket will save you time and expense.

Inquire about these and other improvements in G-E watthour and demand meters. Address the nearest G-E sales office, or General Electric, Schenectady, N. Y.

400-13

GENERAL ELECTRIC

Electrification Cuts Mill Cost

By F. A. KOLB
Duquesne Light Company

C. G. Hussey & Company, Pittsburgh, Pa., manufacturers of copper products for nearly a century, recently completed one step of a forward-looking modernization program by replacing a steam engine, driving a copper-rolling mill, with a 500-hp. synchronous motor and by installing a 150-kva. static condenser.

J. P. Lally, president of the company, decided to combine the operating economy of purchased service over private-plant operation with the saving obtainable from power-factor correction and at the same time secure the production advantage which results when a steam engine is replaced with electric drive for copper rolling. The resulting annual saving in operating costs turned out to be approximately 50 per cent of the necessary investment. If the value of the improvement in production is included this plan of modernization will pay for itself in one year.

This company has been purchasing electric service at 220 and 2,200 volts for approximately 1,000 hp. in miscellaneous load. Due to the peculiarity of the motor applications the power factor on both of these services was approximately 45 per cent. By installing the 500-hp., 80 per cent power-factor synchronous motor on the 2,200-volt service and the 150-kva. static condenser on the 220-volt service the power factor on both of these services has been raised to approximately 95 per cent. The annual saving due to this improvement is equivalent to 23 per cent of the total annual cost of purchased electric service.

In addition to the 1,000 hp. of miscellaneous motors for which service was purchased this company operated three steam engines, with a total rating of 1,000 hp., driving copper-rolling mills. Steam for the engines was supplied by four 333-hp. stoker-fired boilers. These mills include breakdown, hot-strip and cold-strip units. The cold-strip mills were electrified first because they were suitable for synchronous-motor applications and, in addition, had the greatest number of operating hours of any of the three mills. Due to these characteristics it was possible to obtain the power-factor correction required and at the same time take advantage of the lower purchased-power cost due to the higher load factor. When the 500-hp. motor was installed it was possible to eliminate one boiler and one engine and to save about 30 per cent of all steam-operating expenses exclusive of labor.

With steam operation the driving engine was located at the end of the cold-strip mills. When the mills were electrified the motor and speed reducer were installed in the center of the mills driving on either side. The ratio of the speed reducer provides for a considerable increase in roll speed. The result is a very modern mill and production has been increased approximately 50 per cent. Speed varied with load where steam-engine drive was used, producing roll marks on the copper sheets. With the constant-speed synchronous-motor drive this difficulty has been eliminated.

The 500-hp. synchronous motor has a 400 per cent pull-out torque. Oscillograph readings taken after electrification indicate that instantaneous loads on this motor run as high as 1,600 kva. The fact that loads of this magnitude occur is of considerable importance when selecting a synchronous motor for such a mill, as the motor must be designed with sufficient pull-out torque so that it will not drop out of synchronism due to high instantaneous loads.

It is expected that the two other steam-engine driven mills will be electrified within the very near future and the boiler plant completely shut down. This first step is an example of the mutual advantage that results when a plant executive combines his modernization plans with the recommendations furnished by the power company and with the suggestions of the equipment manufacturer.

A 500-hp. synchronous motor with speed reducer drives this cold-strip mill

Frame over motor is for hoisting it during severe flood conditions

•

Strip Units Protect Fire Extinguishers

By MILTON EPSTEIN
Electric Heating Engineer,
St. Louis, Mo.

Analysis of the problem of keeping standard fire extinguishers from freezing was made for a large oil company which has many hundreds of such extinguishers in operation throughout the country. This study revealed that (1) lamps do not afford adequate pro-

A PERFECT LANDING

Through its reliability in radio and electrical equipment, Synthane contributes a vital part to the safety of night flying. You can secure this same reliable performance in *your* products if you use the same dependable insulation—Synthane laminated bakelite.

SYNTHANE LAMINATED BAKELITE
SHEETS • RODS • TUBES
FABRICATED PARTS

Send for Sample Book

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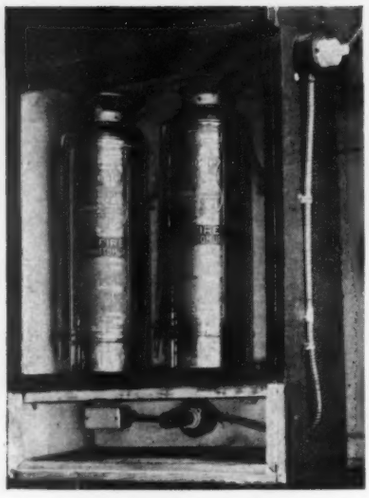
CORPORATION OAKS · PENNA



Heating unit and bimetallic control element located in bottom of box inclosing fire extinguishers

tection, as burn-outs may not be discovered for some time; a lamp may fail and let the extinguisher freeze at the very time a fire breaks out; (2) upkeep of lamps is high, as they have an average life of 1,000 hours, while tests which have been conducted show that heating elements have operated as many as 25,000 hours and are still going; (3) with automatic temperature control a regular heating element is not expensive. A 100-watt heater will consume 360 kw.-hr. through the season; automatic control will save 194 kw.-hr., which at a rate of 2½ cents per kilowatt-hour amounts to $4.85 per year.

The heating unit which has proved so successful in this field screws into an ordinary lamp socket. The resistance wires are embedded in a refractory under a very high pressure and a unit so built and used on the comparatively easy service of keeping the box warm should have an indefinitely long life.

The control instrument is of the bimetallic strip type, has an accuracy of plus or minus 30 deg. F. and is entirely practical for the work. The wattage input varies with the locality, and for a box holding either one or two extinguishers the following wattages have been found suitable:

South	25 watt
Central South	50 watt
Central North	75 watt
North	100 watt

Record of St. Louis temperatures during the season of 1933-34 shows that the temperature was above 40 deg. F. 54 per cent of the time. Therefore, 54 per cent of the current can be saved if heating control is provided.

Earns 33% on Salient-Pole Rotors

By GEORGE L. BEAVER
General Electric Company,
San Francisco

In modernizing the mill of the Sperry Flour Company at South Vallejo, Calif., General Mills, Inc. developed a new approach to the power-factor correction problem which offers a wide field of applications in the industrial field. In common with most plants of its type, this 4,000-bbl. flour mill is operated as two "units" from two large line shafts, to which machinery for each unit is belted. Each of the two line shaft units was driven by a 400-hp., 300-r.p.m., wound-rotor induction motor.

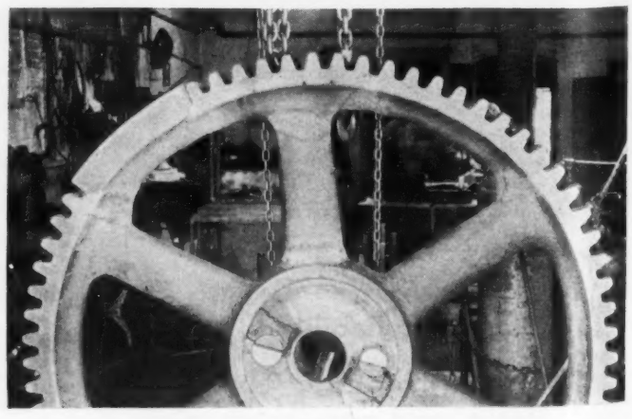
Power for operating the plant is obtained at 2,200 volts from the Pacific Gas & Electric Company, whose rates provide a bonus for the maintenance of high total plant power factor, that led the management to consider various steps by which power factor could be increased. Some improvement in power factor was made by changing certain small motors to minimize "overmotoring." Minor changes in transformer connections resulted in still further improvement, but the plant power factor was not raised sufficiently to earn a bonus. Other methods of improving power factor were considered, such as the complete replacement of induction motors with new synchronous motors, the application of phase advancers to induction motors and the use of capacitors on the plant feeders. In each case the savings possible were not sufficient to show a particularly favorable return upon the capital investment involved in the modernization.

Further study revealed that it was entirely practical to convert two 400-hp. induction motors to the synchronous type by substituting salient-pole rotors and thereby improve the total plant power factor sufficiently to earn an attractive return on the required capital outlay. Besides, the rebuilt motors would handle the loads usually encountered in accelerating, synchronizing and operating the flour mill line shafts. This was checked by tests of each line shaft to determine its approximate moment of inertia and average friction load during acceleration. These data established the starting and pull-in torque which had to be provided in redesigning the induction motors. The probable reduction of voltage applied at the motor terminals during starting and the corresponding reduction in starting torque were likewise checked. It was found that the utility's service facilities were entirely adequate even under the expected high values of low-power-factor starting current drawn from the line.

Two new synchronous rotors (furnished less shafts), collector ring assemblies, two small motor-generator sets for supplying excitation and two push-button, magnetic-control, reduced-voltage starters were ordered. As the stator windings were old and dry and could not be expected to last many more years and because appreciable savings were possible by rewinding the motors during the change.

[*Continued on page 61*]

Arc Weld Repairs Large Gear Wheel



This gear wheel, 7 ft. in diameter and weighing 2,500 lb., was repaired by arc welding at a cost of $80. A new gear would have cost several hundred dollars. One spoke and a section of the rim had to be cast and welded into position to replace parts too badly shattered to be reassembled. The welding was done by Menna Welding Company, Toledo, Ohio, using a General Electric single-operator welding generator and electrodes.

new windings were installed. They were designed for full-voltage starting, should such a method prove necessary. As the location of the motors and the construction of the mill building were such that sending the motors into an electrical shop would have entailed considerable expense, the modernization was accomplished at the mill. One line-shaft unit was modernized while the other was kept in operation, keeping production losses at a minimum. The work required only ten days.

The total capital outlay for all equipment, labor and supervision amounted to approximately $11,000. Reductions in power costs (due to raising the plant power factor to approximately unity, plus the savings from reduced motor losses) are approximately $300 per month or $3,600 per year. Thus, the changeover is earning approximately 33 per cent on the investment. Further economy is apparent from the fact that the induction motors were nearing the end of their useful life and would have to be replaced within a short time, anyway. Rehabilitation has given the plant capital account two main-drive motors from which a life equal to that of new motors may be expected.

Thus, improving the power factor by converting induction motors to the synchronous type produced an appreciable saving without increasing the over-all capital investment appreciably. Had the power factor been corrected by capacitors, phase advancers or other devices, not only would an investment in the new equipment have been required but it would have been necessary to make an additional outlay in the near future to rehabilitate the induction motors themselves.

•

Electric Boilers for Paper Making

Pulp and paper mills in Canada bought more energy during 1933 for use in electric boilers than for all other purposes. Expressed in millions of kilowatt-hours, the former amounted to 3,488 and the latter to 3,151. About two-thirds was in Quebec—2,561 and 2,107, respectively. For Ontario the figures are 853 and 673.

In addition to this purchased energy many pulp and paper companies operate their own generating plants. The installed turbine capacity of these plants at the end of 1934 was 605,346 hp., while 1,031,000 hp. of motors was operated on purchased energy. The data are from a report on the water-power resources of Canada by the Dominion Water Power and Hydrometric Bureau.

Aid Inspection With 45 Ft.-Candles

At the Lindsay (Calif.) Ripe Olive Company plant good lighting is paying for itself daily in improved employee efficiency. To provide an even, glareless light for the prolonged visual effort required in sorting olives ten Holophane lighting units were mounted on a pipe support directly over the sorting belt. Each unit is totally inclosed with a refracting lens which illuminates a path the exact width of the belt to an intensity of 45 ft.-candles.

So successful has the additional lighting proved in improving plant output, with lessened fatigue of employees, that sixteen additional units are being added on other similar belts.

Cable Tape

The insulation foundation of the Varnished Cambric Cables used in high voltage networks also forms the arteries through which flows the life blood of your power systems.

Unless these arteries are constructed of the best available materials, invisible power thieves, working day and night, not only steal an appreciable percentage of your power, but in many cases, cause complete stoppage of the power flow through breakdown of the wall.

Westinghouse, after several years of study, has perfected a cable tape which assures you of . . . low power loss . . . high dielectric strength, and high resistance to hot oil. There is also available to you, a high grade, oil-packed tape for your cable splices.

Address Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

◆

Varnishes - Cements - Compounds - Treated and Untreated Fabrics and Papers - Micas

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Westinghouse

CABLE TAPE

R 53018

Daytime Conditions for Night Driving

Night driving without headlights or glare and with virtually presunset visibility has been made possible near Pompton Lakes, N. J., by the installation of sodium-vapor highway lighting equipment.* Some observers say that cars can be easily seen after dark at a distance of 2,000 ft. and curves can be detected even further without the aid of headlights. Just as high driving speeds can be maintained with safety on the darkest night as in the daytime, it is claimed. Irregularities in the road are readily distinguishable and glare from approaching headlights is avoided because no headlights are necessary.

This new installation, which is to serve primarily as a proving ground for highway lighting, is 1 mile long. It consists of 6.6-amp. lamps suspended from a stiff-leg attached to and projecting upward from power line poles spaced 115 ft. apart along the highway. Part of the lamps are 4,000-lumen units in prismic reflectors; the remainder are 6,000-lumen units in metallic reflectors. The golden glow of the lamps, coupled with their low intrinsic brilliancy, minimizes any direct glare. To permit comparison of the effects produced by different lamp elevations, the lamps are supported so their mounting height may be adjusted up to a maximum of 30 ft. Alternate lamps are connected to separate circuits so that one-half of them can be extinguished to study the illumination effects with 115- and 230-ft. spacings.

Curves are easily distinguishable at a distance because the lamps are shifted from their normal position over the road to positions on tangents to the roadside at curves.

"Butterfly" type metal reflectors are used, consisting of six vanes of highly polished sheet aluminum arranged in a T-shape. Two of the vanes form a covering for protection against the weather. The sides of the fixture are set parallel to the roadway and appear to be single vanes slightly angled in the middle, giving a winged effect. Bottom and sides of the fixture are open and provide a downward and longitudinal distribution of light along the roadway. The lamp itself is placed vertically, base up, at the intersection of the X-shaped vanes of the fixture. The side vanes prevent the rays from spreading transversely, thus eliminating the age-old criticism of high-intensity street lighting, it has been claimed. Sufficient transverse light is emitted, however, to make roadside signs and pedestrians easily visible.

Individual transformers mounted high on each line pole serve the lamps from two series-lighting circuits. The same pulleys which permit adjustment of lamp-mounting height also allow the fixtures to be lowered to the curb for cleaning and relamping, thus facilitating servicing and reducing maintenance costs.

This installation was made under the sponsorship of the Westinghouse Lamp Company, Westinghouse Electric & Manufacturing Company, the Jersey City Power & Light Company and the Chamber of Commerce of Pompton Lakes.

*A news item on the inauguration of this project was given in the February 16, 1935, issue, page 47.

Sodium lamp mounted 30 ft. high cuts glare

A pulley device permits adjusting the mounting height and lowering of each lamp for servicing. Individual lamp transformers are mounted on each pole.

High-intensity highway light

Butterfly type fixtures give downward and longitudinal light distribution and avoid wasting light beyond roadside. Looping of the cable at fixture reduces strain on the connection.

•

Surplus Power Used for Steam Generation

Seven electric steam-generating stations, totaling 215,000 kw., have been placed in operation since January, 1933, by the Hydro-Electric Power Commission of Ontario, F. H. Chandler, assistant engineer of the commission, reports in the January *Bulletin*. These stations use surplus power in all cases. About 250,000 tons of coal have been displaced per year by their operation. Generation of steam electrically will be curtailed from time to time as more power is required for domestic and commercial use.

Loss of energy due to bleeding is the major item of the small loss and ranges from 3 to 10 per cent, depend-

"Reaches almost everywhere"

ALL-ROUND UTILITY PLUS REAL ECONOMY

Low first-cost, low up-keep, combined with great versatility—that's why the Murray Demountable Crowsnest is in wide use. One man can speedily operate it and utilize over 100 positions. Rotation through 360° with 10 angles of inclination. Mountable on light commercial trucks.

Some of its uses—tree trimming, servicing street lights, servicing traffic lights, overhead line inspection, painting standards and connecting services.

Write for interesting 16-page booklet illustrating its all-round utility.

$225

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INCLUDES ALL MOUNTING MATERIAL

METROPOLITAN DEVICE CORPORATION
1250 Atlantic Avenue, Brooklyn, N. Y.

MURRAY DEMOUNTABLE CROWSNEST

Installation Ratings of Electric-Steam-Generating Stations

Plant	Location	Rating, Kw.	Volts	Pres. in Lbs.	Steaming Capacity Lb./Hr.	Make of Generator
Ontario Paper Co.	Thorold	3–30,000	6,600	200	.....	Canadian G. E.
Great Lakes Paper Co.	Ft. William	2– 8,000	2,300	135	50,000	Dominion Eng. Co.
Provincial Paper, Ltd.	Port Arthur	2–12,000	6,600	185	72,000	Canadian G. E.
Provincial Paper, Ltd.	Thorold	1– 7,500	2,300	...	.....	Penzold
Interlake Tissue Mills	Merritton	1– 7,500	2,300	...	.....	Penzold
Abitibi Power & Paper	Smooth Rock	2–25,000	6,600	...	.....	Canadian G. E.
Howard Smith Paper Co.	Cornwall	1–20,000	6,600	185	60,000	Penzold

ing upon characteristics of the feedwater. Sulphates and carbonates present in the feedwater collect in the generator, lowering resistance and increasing current flow between electrodes. Since the electrodes are designed for a constant-current density it is necessary to bleed water from the generator at the point where the greatest concentration appears.

As a rule it is possible to supply steam with less than 1 per cent moisture, depending upon the efficiency of the separators employed. Three makes of generators are in use:

Canadian General Electric Company generators, used in three of the plants, are of the two-compartment type. Water is pumped from the lower compartment to the upper steam-generating basket. It is claimed that the rapid motion of the water past the electrodes assists the steam bubbles in getting to the surface.

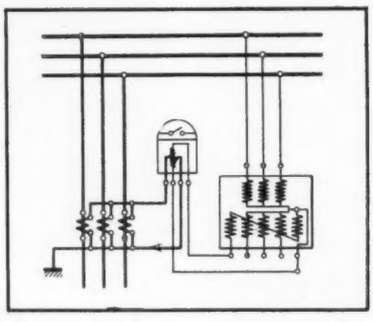
Single shell-type generators, in which the electrode nest is suspended in the water, are used at the Great Lakes Paper Company plant. These generators are made by the Dominion Engineering Company.

"Penzold" generators, of a totally different design, are used in three of the plants. Ceramic or porcelain stacks are used in these units to restrict the water path resistance between electrodes. It is claimed that this feature insures equal phase loading and prevents energy conversion at the electrodes. It is further claimed that the generator can be readily designed for a considerable range of electrical resistance of feedwaters by varying the number and spacing of the stacks. No circulating pumps are required as the depth of immersion is controlled by feedwater and bleed valves. The design is a German development manufactured in Canada.

Ratings of the various installations are given in the accompanying table.

Neutral Power Relay Clears Faulted Cable

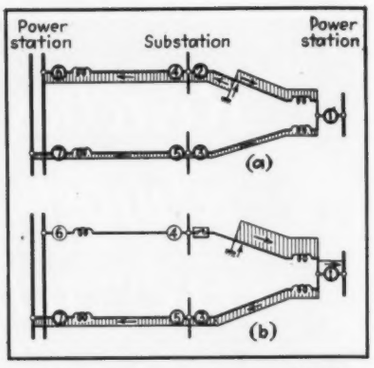
Experience of the Berlin (Germany) Electric Company with ground compensation by Petersen coils and a system of relays, used for location and isolation of ground faults in large medium-voltage, grounded-neutral cable networks, has resulted in a high degree of reliability. Cable ground faults, in this type of system, commencing as small arcs very quickly turn into dead short circuits to ground unless some inductive suppression equipment (Petersen coil) lengthens the period of transition by balancing the capacitive currents at the grounded point. Within this period the affected cable must be switched out before short circuit occurs.



Circuit for ground fault relay

To permit the isolation of the faulted cable when a ground occurs a protective device is necessary which will signal the fault, indicate the phase concerned, show the fault location or automatically switch out the cable in the shortest possible time.

Ground protection relays used by the Berlin Electric Company in its 30-kv. system, as described in a recent issue of the *AEG Progress*, obtain from the voltage displacement and neutral current of the grounded system the neutral power, direction of which makes it possible to trace and isolate the faulty section. Working after the manner of a wattmeter, the relays depend for operation on the in-phase component of the ground current.



In-phase neutral current distribution in typical faulted 30-kv. loop

In-phase currents divide up in sign and magnitude as indicated. Greatest active neutral power occurs on either side of the fault. Only those relays through which neutral current flows to the bus may trip. In-phase current flowing away from the bus causes the relays to lock. Since the relays near the power station are provided with a longer tripping time (wider gap between contacts) than at intermediate points, such as substations, relay 2 will trip first as a result of current distribution shown at (a). After relay 2 has tripped (b) relays 1 and 3 follow, clearing the faulted cable. Due to their longer tripping time, 6 and 7 do not arrive at the tripping stage: 4 and 5 are locked due to current direction.

•

Watts Saved by Copper

Eight per cent of the watts delivered to three 500-watt lamps placed from 50 to 100 ft. from the source can be saved if the wire size is No. 8 instead of No. 14.

The chart at left, recently drawn up by the Cleveland Electric Illuminating Company's power division, shows also what No. 10 or No. 12 would do. It indicates the reduction in consumption that can be effected by adequate sizing of the branches.

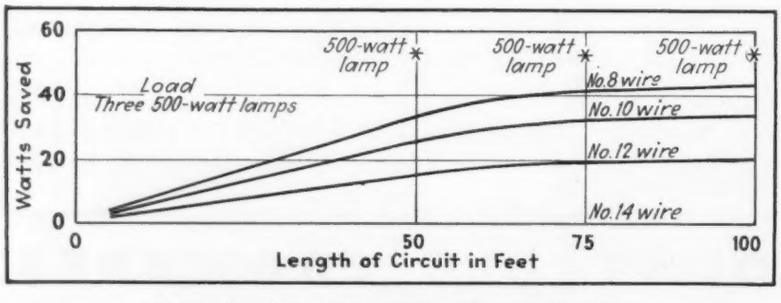
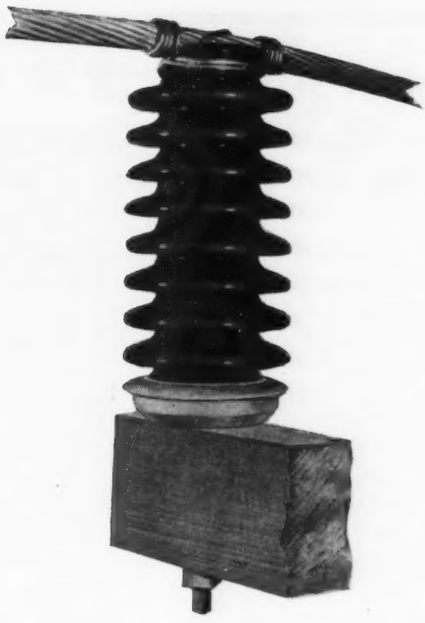


Chart showing power saved in branch circuits



The Station Post shown above is a parallel development with the Line Post. It is a most attractive unit for outdoor substations. Investigate!

THE LAPP LINE POST

THE Line Post reduces insulator design to its fundamentals—a single piece of porcelain cemented into a malleable iron base.

THERE is no pin or other conductive material within the insulator and as a result the charging current is low and the point of radio interference starting is high. Puncture becomes practically impossible.

THE Fog Type leakage surface assures ability to handle contaminated atmospheric conditions and the short, sturdy petticoats protect the body from damage under power arcover and the attacks of stones and bullets.

ALL attachments are external, eliminating thermal bursting forces from within and assuring long, trouble-free life.

THE Line Post provides the things YOU have always wanted from pin type insulators. Let us tell you about it. Ask for Bulletin No. 112.

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Teaching Lighting in the Schools

By P. J. WRIGHT
Westchester Lighting Company,
Mount Vernon, N. Y.

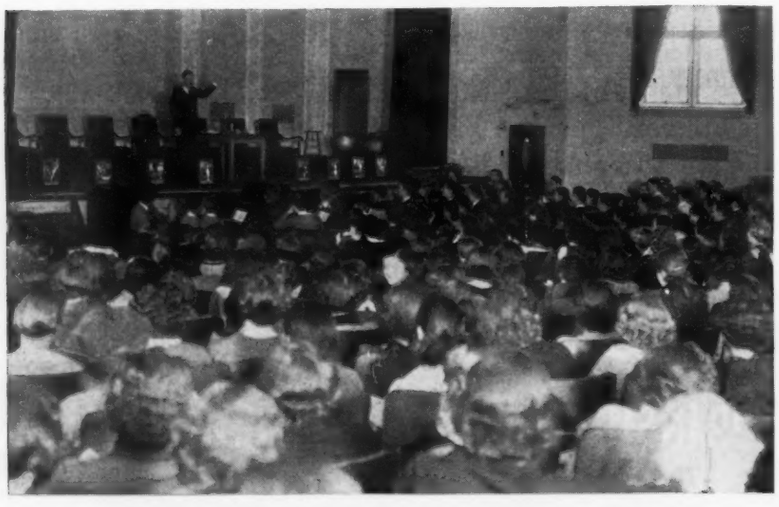
Westchester Lighting Company has developed a co-operative educational program to teach the children of the public schools the importance of caring for their eyes. A series of instructive lectures and demonstrations adapted to various grades in the public schools was worked up in co-operation with the school superintendents. The lighting lecture programs were conducted according to modern teaching methods and were correlated with the New York State syllabus, designed for the primary, intermediate and high school groups.

In the primary groups the principles of proper illumination were impressed upon the child's mind through films, slides and dramatization of basic principles. The latter forcibly taught the harmful effect of improper lighting and emphasized the advantages of proper illumination.

In the intermediate group the history of lighting was graphically portrayed in exhibits of museum pieces—objects representing the various stages in the evolution of light. Since the history of lighting is not usually included in the school curriculum, this contribution to the child's store of knowledge was welcomed by teacher and student alike.

The high school group included two divisions, academic and trade. In both emphasis was placed upon the necessity of having enough light and of having it properly distributed and adapted to the purpose for which it is intended. In the academic division the history of light was developed through the use of museum pieces. In the trade division the development of the incandescent lamp, the effect of improper voltages and the difference between lamps was discussed.

Helping the child discover the value of good light for reading



Westchester school children listening to a lecture on lighting

The thoroughness of the Westchester experiment is indicated in the use of songs which tell a story of lighting. At the assemblies these songs were sung as an opening feature and served to interest the children in the subject and the speaker. The music teachers continued to use them throughout the school year.

Whenever schools would permit field trips, classes would be taken to the general offices of the lighting company to hear another and more comprehensive lecture on lighting principles. They visited the display floor and learned the difference between types of appliances and how a lighting company functions and the part it plays in the growth and development of a community.

These ideas were further developed in the classroom. Arithmetic was taught by simple lighting problems; health and safety by correct lighting principles; English composition by letters to the lighting specialist, requesting a lecture or expressing appreciation for one previously enjoyed; language and spelling by the addition of new electrical terms to the vocabulary, such as "fuse," "watt," "current," "short circuit" and "volt."

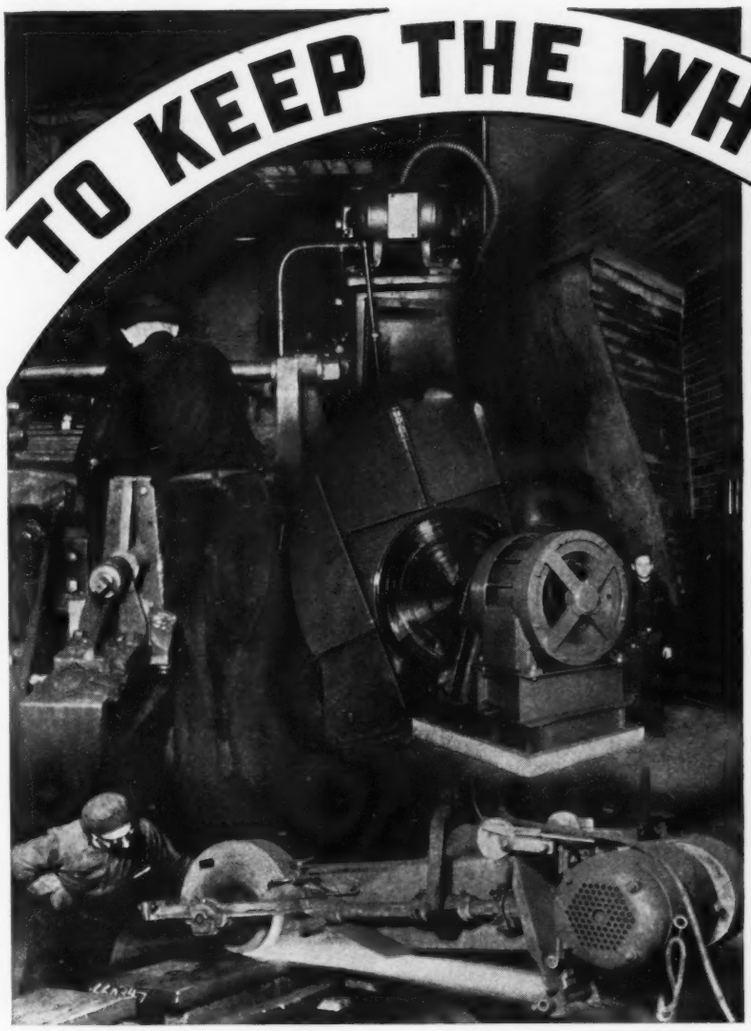
Incidentally, these letters showed clearly that the message of proper lighting had been thoroughly learned and that the children were insisting upon the correct use of lighting in their homes. They learned the essential facts that many people never learn until late in life. They were carrying their story home to their parents. Electric lighting ceased to be a mystery.

•

Range Wiring for Trial Installation

As an aid to breaking down sales resistance of prospective range customers, the Michigan Electric Light Association recommends a temporary wiring arrangement whereby a range may be used for a given period and the cost of such usage registered by a separate meter. By installing a meter

TO KEEP THE WHEELS TURNING



TO KEEP the wheels turning requires the best of qualities in both men and motors. We, at Lincoln, accept it as our responsibility to see to it that "Linc-Weld" motors have more than the required horsepower to keep your wheels turning. This extra horsepower, available in every "Linc-Weld" motor, assures you of extra protection against failure.

And the "Linc-Weld" motor is also amply protected against the attacks of dust, dirt and acid fumes. Its waterproof insulation is permanently pliable—will never dry out or crack.

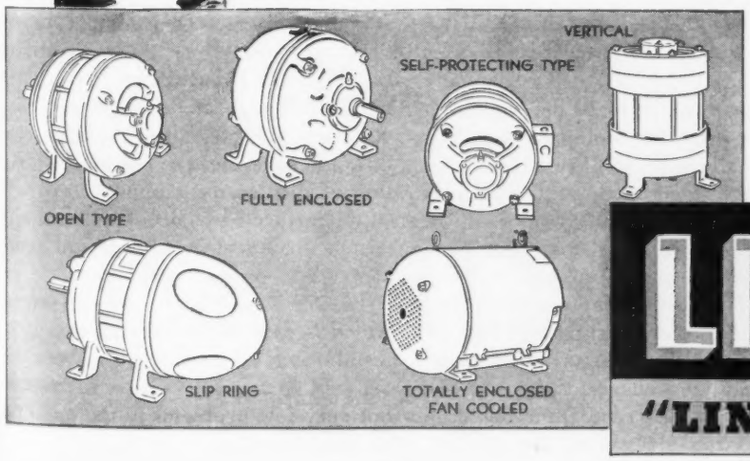
The "Linc-Weld" frame is built of skyscraper construction—rolled steel for greatest strength and rigidity with least bulk. Thus it contains more iron and more copper to give "Linc-Weld" the extra horsepower without sacrifice of power factor or efficiency.

We suggest that if it is responsibility to keep the wheels turning you investigate all the advantages "Linc-Weld" motors can offer you. Write THE LINCOLN ELECTRIC COMPANY, CLEVELAND, OHIO.

M-17

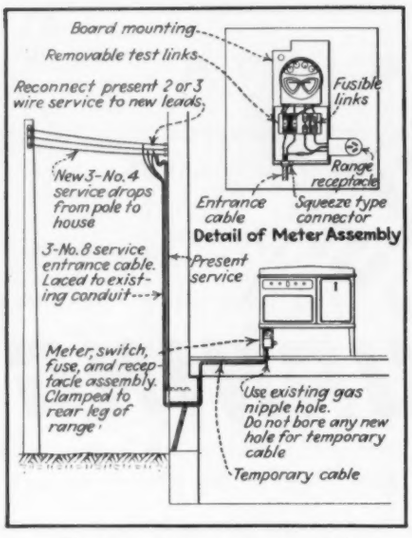
POP "You know, Lad, you never get anything for nothing. Now who pays for the extra overload capacity of the 'Linc-Weld' motors?"

LAD "That is one of the profits of progress, Pop. The 'Linc-Weld' user profits by Lincoln's progress in motor design. As long as you buy old style motors you pay for the losses of lethargy."



LINCOLN

"LINC-WELD" MOTORS


Board mounting
Removable test links
Reconnect present 2 or 3 wire service to new leads
Fusible links
Range receptacle
New 3-No. 4 service drops from pole to house
Entrance cable
Squeeze type connector
Detail of Meter Assembly
3-No. 8 service entrance cable. Laced to existing conduit
Present service
Meter, switch, fuse, and receptacle assembly. Clamped to rear leg of range
Use existing gas nipple hole. Do not bore any new hole for temporary cable
Temporary cable

Hook-up for ranges on trial recommended in Michigan

and receptacle clamped to a leg of the range and laying a piece of 3-No. 8 service-entrance cable of the A.E.I.C. type temporarily in place full use of the range is possible without the expense of a permanent wiring installation. In many cases it will be advisable to install a 3-No. 4 set of service drops from the pole to the premises. The meter, receptacle and cable can all be salvaged and used on other trial installations.

Installing and removing the trial equipment is estimated to be approximately $6.

•

Selling With a Sales Coach

By W. H. SINKE
Central Power Company,
Grand Island, Neb.

In the first three months of its operation on the system of the Central Power Company the sales coach sold fourteen ranges, eleven water heaters, eight refrigerators and two washing machines, making a total of $4,361. The cost of the merchandise was $3,617.73 and the profit therefore was $743.27. The cost of operation of the coach for the three months, including gas, oil, etc., was $72. Salesman's salary was $420, depreciation $110.25, salesman's expense, hotels, meals, etc., $71.81, making a total expense of $674.06. This made a net profit of $69.21. The annual increase in revenue was estimated at $1,367.50, making the cost per dollar of increased revenue a negative quantity; in fact, a profit of 5 cents on each dollar.

Our sales coach was purchased from the General Electric Company through its local distributor and was placed in service October 1, 1934. For motive power a Ford coupe is used. The cost of the coach and coupe amounted to $1,189.49 and the expense of securing the car and coach from Erie, Pa., was $124.27, making a total of $1,322.76. Depreciation is being figured at a rate of $36.75 per month over a period of 36 months.

The coach is used for working our smaller towns, where we do not have display offices, and in the rural communities. It is equipped with the major appliances—refrigerator, range, water heater, washing machine, lift-top refrigerator, vacuum cleaner and also toaster, percolator, waffle iron, iron, mixer and sandwich maker. All of the appliances are bolted down secure, thus eliminating the necessity for unpacking and packing for each demonstration. A small seat has been built in over the rear wheel for the convenience of the customer while talking over appliances.

Dealers' co-operative plans

The salesman in charge of the coach is well experienced in selling and also servicing. Several ranges have been brought back into service by him through replacement of units, and by making minor repairs various smaller appliances are returned to service from time to time.

Dealers are contacted in all communities visited. Most of them sell no major appliance except the washing machine. The purpose of the sales coach—to build load—is explained to them and they are given opportunity to cash in on the company's promotional work as they may wish, according to one or the other of the following plans:

Plan I—The co-operative dealer may purchase electrical appliances from the Central Power Company stock at a discount of 10 per cent from the cash price, the company agreeing to take all responsibility of installation costs, guarantee, etc., and will finance the sale on its standard twelve and eighteen months' payment plan after proper credit approval.

Plan II—Dealer may purchase electrical appliances outright and assume all responsibility of installation, guarantee, carrying charge, etc., at a discount of 20 per cent from the cash price.

Pumping Out Old Gold Mines

By A. KANEKEBERG
Public Service Company of Colorado,
Denver.

With gold at $35 an ounce, electricity is finding a large application in the unwatering of old mines that have lain neglected and desolate for many years. In the territory of the Public Service Company of Colorado collaboration between equipment suppliers, the company and mine operators has resulted in a more or less standardized assembly of centrifugal pump, motor and control that can be easily moved from one location to another. These assemblies vary from single and multi-stage centrifugal pumps to the deep-well type turbine pumps. They are all equipped with slings for lowering in the mine shaft or manway.

Many applications are in comparatively deep, crooked mines that make very little water. One mine, 1,376 ft. deep, was sunk along a vein requiring the installation of 22 rollers. The normal seepage amounts to less than 40 g.p.m. of water. But the shaft condition is such that the correct installation of displacement pumps has to be supplemented by deep-well turbine pumps or several installations of small centrifugal pumps.

The new and old meet
Below the modernity of 11-kv. service stands a survivor from other days.

Electric cable for mine service which is used for supplying energy to installations of this type has been developed to a point where it presents but very few problems to the engineer or miner.

THIS IS A SHEET OF BUILT UP MICA

Natural Mica has a dielectric strength of approximately 1000 volts per .001 inch of thickness. Its even cleavage, toughness, elasticity and flexibility adapt it to many uses.

Macallen built up Mica sheets are made to standard formulas to meet various requirements including—high temperatures, molding, binding, turning, etc. Made in various thicknesses. Our engineering service is at all times anxious to cooperate with you.

Mica is not a substitute—there is no substitute for Mica as an insulating material unaffected by heat, moisture or oil.

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MEN OF THE INDUSTRY

L. A. S. Wood Made President of Illuminating Society

L. A. S. Wood, chief lighting engineer Westinghouse Electric & Manufacturing Company, has been elected president of the Illuminating Engineering Society for a twelve-month term beginning October 1, 1935.

One of the foremost illuminating engineers in the world, Mr. Wood has been

L. A. S. Wood

closely identified with the lighting industry ever since he began his business career and is thoroughly familiar with lighting practice not only in this country, but also in England, of which country he is a native.

He was born in London and received his education at the City of London School, the University of London and the Finsbury Technical College. He was connected with the Edison & Swan United Electric Light Company in the early days of the incandescent lamp and later devoted many years to the development of the arc lamp. He took a leading part in laying out street-lighting systems in the larger European cities and also the lighting of many of the public buildings for the British government.

Mr. Wood came to the United States in 1911 to introduce the flame carbon arc lamp and was shortly afterward appointed arc lamp expert for the Westinghouse company, with headquarters at East Pittsburgh. Soon after the introduction of the "Mazda C" lamp he became associated with the George Cutter Company of South Bend, Ind., as illuminating engineer, and later was made sales manager.

At the time the Cutter Company was absorbed by the Westinghouse Electric & Manufacturing Company, Mr. Wood was made manager of the company's street-lighting department, with headquarters at South Bend. He was located in the Cleveland Works as manager, lighting division, prior to his recent transfer to New York as chief lighting engineer.

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► M. P. CONWAY has been elected chairman of the Iowa Public Service Commission. Mr. Conway first became identified with the commission in 1933.

► F. W. THOMPSON of Appleton, Wis., has joined the Four Wheel Drive Auto Company, Clintonville, Wis., as director of research.

► H. EDMUND MACHOLD, formerly Speaker of the New York State Assembly, has been elected president of Northern New York Utilities, Inc., a subsidiary of the Niagara Hudson Power Corporation, succeeding Charles E. Norris, who resigned several months ago.

•

K. M. Robinson Heads Northwest Association

K. M. Robinson, president of the Idaho Power Company, Boise, was named president of the Northwest Electric Light and Power Association at the recent annual meeting held in Seattle. Mr. Robinson has been associated with the Idaho Power Company and predecessor companies since 1911. During that period of service he has been local manager, division engineer and division manager at Payette, served in an executive capacity at the general offices in Boise, later was made assistant general manager, in 1933 vice-president and general manager and last year president.

K. M. Robinson

I. E. Moultrop Retires from Boston Edison

Irving E. Moultrop, chief engineer of the Edison Electric Illuminating Company of Boston and head of its construction bureau, retired from active service with that utility on August 1, after more than 43 years of continuous association. He was born in Marlborough, Mass., in 1875, and after graduating from high

I. E. Moultrop

school began work as an apprentice with the Whittier Machine Company, Roxbury, Mass. He was chief draftsman when he resigned to join the Edison company's staff in the same capacity, in 1892. He rose steadily, serving as mechanical engineer and assistant superintendent of the construction bureau, and in 1926 was made chief engineer by the late President C. L. Edgar, six years later taking over construction bureau direction.

Mr. Moultrop has received many tributes in his professional career, including the Elliott Cresson Gold Medal of the Franklin Institute, which referred to the engineering skill and courage displayed in the Edgar station development under his direct supervision, and the honorary degree of mechanical engineer from Stevens Institute of Technology. He has long been widely influential in professional societies and has been or now is a vice-president of the A.S.M.E., A.I.E.E. and American Engineering Council. He is president of the Engineers Club of Boston and has served on many important engineering missions in this country and abroad.

•

► SIDNEY HOSMER, vice-president and general manager of the Edison Electric Illuminating Company of Boston, assumed the duties of acting head of the construction bureau on August 1, upon

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STEEL-GLASS CELL
27 FPG — 1040 AH

Yours ONLY WITH PHILCO

The March of Time is proving beyond question the outstanding merit of Philco's Steel-Glass development.

Engineering and operating departments are being convinced daily of the "plus years" built-in this *electrically and mechanically perfect* contribution to battery efficiency.

Steel-Glass is of high sustained voltage and capacity—spray-proof and compact—easy to install and maintain—free from repairs and guaranteed by Philco to give the lowest operating cost.

With Steel-Glass Construction the low cells, resulting from dropped or buckled plates, shifted and punctured separators, are absent—Steel-Glass is an assembly *Anchored in Glass.*

Once installed, Philco's Engineering Inspection Service, periodically rendered, insures maximum reliability and economy of operation.

Investigate the liberal allowance Philco will make for your old batteries—replace them with Steel-Glass Cells of from 10 A.H. to 1040 A.H.

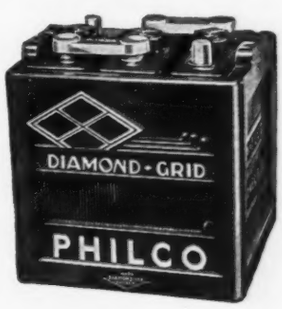
Write today for catalog 2440-A and get the complete FACTS!

Listen to Boake Carter over Key Columbia Stations

PHILCO DIAMOND ◈ GRID *Batteries*

X SUPER-POWER BATTERIES

A multi-plate, long-life Philco Diamond-Grid Battery for modern car operation. POWER for EVERYTHING—quick starting, bright lights, auto radio, accessories. Also available for all makes of trucks and buses. The crowning achievement of over a quarter century of experience in building quality batteries.



PHILCO, Battery Division, Tioga and C Streets, Philadelphia, Penna.

Boston · New York · Pittsburgh · Cleveland · Atlanta · Chicago · St. Louis · Kansas City · San Francisco · Los Angeles · Portland · Seattle

the retirement of Irving E. Moultrop as chief engineer. Mr. Hosmer was formerly head of this bureau and will continue his other executive tasks while in charge of this branch of the company.

▶ W. S. Anderson, Newcastle, N. B., has been appointed chairman of the New Brunswick Electric Power Commission.

▶ L. C. Parks, for nine years Cumberland district manager of the Tennessee Electric Power Company, has resigned to become vice-president and general manager of the Gulf Power Company at Pensacola, Fla. He has been succeeded by Clarence Watson, manager of the middle Tennessee district.

▶ W. C. Hornberger has been named acting general manager of the newly reorganized Arizona Edison Company, Inc. Mr. Hornberger held the position of operating manager for the company while it was in receivership under M. E. Cassidy. This receivership last month was terminated by the United States District Court.

▶ J. K. B. Hare, prominent sales executive of the Westinghouse Electric & Manufacturing Company, has been appointed manager of the Buffalo office, taking the place made vacant by the promotion of H. F. Boe to the position of assistant manager of the eastern district with headquarters in New York.

▶ J. J. Brown, chairman and president of the Foster Wheeler Corporation, has resigned as president. He will continue as chairman of the board. Harry S. Brown has been elected president. David McCulloch was elected executive vice-president and Walter F. Keenan, Jr., George B. Ferrier and J. J. Nelis were elected vice-presidents.

▶ Harry W. Beedle has been appointed New England sales manager of the Electric Storage Battery Company, with headquarters at Boston, succeeding Thomas H. Dooling, who was lately transferred to executive duties on the Pacific Coast. Mr. Beedle has been with the company since 1900, with the exception of nine years spent in Montreal as power and battery engineer for the Bell Telephone Company of Canada. He went to Boston in 1916 and has been assistant manager for about fifteen years.

▶ C. E. Blee, principal assistant engineer of the British Columbia Electric Railway Company, Vancouver, B. C., for the past twelve years, has been appointed hydraulic engineer for the Tennessee Valley Authority, with headquarters in Knoxville. Mr. Blee obtained his early experience with the B. C. Electric in Victoria and after connections with engineering undertakings in San Francisco and various parts of California and Oregon he returned to the British Columbia utility in 1923 as principal assistant engineer in the construction department. During the past twelve years he has taken a responsible part in the design and execution of all the company's major power projects.

•

Bar Association Honors G. R. Grant of Boston

George R. Grant, general attorney of the New England Telephone & Telegraph Company, Boston, was elected chairman of the section of public utility law at the convention of the American Bar Association in Los Angeles, Cal., on July 16. Mr. Grant was educated at Cornell University and its school of law

Bachrach G. R. Grant

and has specialized in public utility legal affairs during his entire professional career. He is widely known in legislative and commission circles and was the spearhead of the New England company's successful defense in its late rate case before the Massachusetts board.

•

▶ James P. Barton has been appointed sales engineer, electrical sheet division, American Sheet & Tin Plate Company, Pittsburgh, Pa. Mr. Barton was formerly associated in a similar capacity with the Empire Sheet & Tin Plate Company, Mansfield, Ohio.

▶ W. J. Platka has been appointed export sales manager of the Horton Manufacturing Company, Fort Wayne, Ind., maker of household washers and ironers. Mr. Platka has traveled extensively in Mexico, the West Indies and South America and has made two world tours, all in the interests of American exporters.

▶ O. H. Fogg, executive vice-president of the Consolidated Gas Company of New York; L. A. Coleman, executive vice-president of the New York & Queens Electric Light & Power Company, and R. B. Grove, executive vice-president of the New York Edison Company, have been elected to the executive committee of the New York & Queens Electric Light & Power Company. H. C. Dean, vice-president of the New York & Queens company, has been elected to the board of directors and also to the executive committee.

▶ Harvey C. Couch, president of the Arkansas Power & Light Company, is now a trustee of the Edison Electric Institute for a term expiring in 1937. Of the trustees whose terms expired in 1935, F. D. Comerford, Samuel Ferguson, C. E. Groesbeck and G. O. Muhlfeld were re-elected for three years. New trustees with terms expiring in 1938 are P. H. Gadsden, W. J. Hagenah, A. H. Schoellkopf and E. W. Wakelee. George H. Howard and W. C. Baylies were not re-elected. Their terms expired this year.

▶ Allen J. Smith, formerly vice-president of the General Management Corporation, New York, has been appointed to act in the capacity of technical adviser to the city of Vancouver, B. C., on transportation, light and power.

▶ Frank D. Paine, head of the general engineering department of Iowa State College, has been appointed rural electrification engineer of the Iowa agricultural service. Professor Paine is thoroughly conversant with this work, having been in close contact with rural electrification work since 1915 and was from 1924 to 1928 supervisor on the Iowa project on rural electrification. He also served in 1934-35 as supervisor of the public utility survey for the Iowa state planning board.

OBITUARY

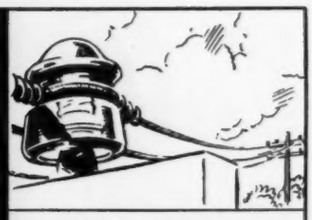
▶ Robert J. B. Feather, electrical engineer with the Columbus Railway, Power & Light Company for 25 years, died in Columbus, Ohio, July 16.

▶ Charles M. Clark, director in many utility companies and formerly president of the Bradstreet Company, died suddenly, July 24, on board his yacht, anchored off Rye, N. Y. Mr. Clark was 61 years of age. He was a director of the Electric Power & Light Corporation, American Power & Light Company, the United Gas Corporation, Carolina Power & Light Corporation, Florida Power & Light Corporation and the Central Arizona Power & Light Company.

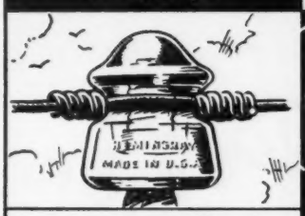
▶ David C. Henny, consulting civil and hydraulic engineer, Portland, Ore., died suddenly in that city July 14. Mr. Henny had gained an international reputation as a consultant, principally in the construction of dams. He was consulted on practically every major dam project of any branch of the federal government in

"LINE UP" WITH THE *Brass Bushed* HEMINGRAY FOR THESE 10 POINTS OF ECONOMY . . .

Brass bushed smooth threads for insulator pin.



Greater mechanical strength.

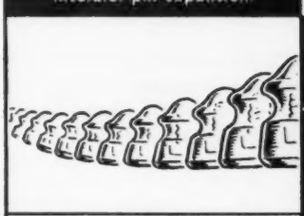


Sustained dielectric strength.

Unaffected by sudden temperature changes.

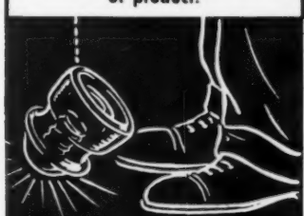
Withstand maximum insulator pin expansion.

Never age or deteriorate.



Controlled uniformity of product.

All surfaces impervious to moisture.



Tougher—withstand rough handling.

Clear and flawless for easy inspection.

HEMINGRAY INSULATORS

THE G-E TIME SWITCH FOR CONTROLLING WATER-HEATER LOADS

Cover removed

Saves ON INSTALLATION

YOU should see how easily this switch "installs." It has flexible leads that facilitate wiring; no fittings are necessary. It fits in any convenient knockout; is light in weight, compact, and takes up little space. These features save time and expense.

Then, too, with the G-E Type T-11 switch, your investment is small and your maintenance and inventory costs are low. These savings are possible because the T-11 time switch is especially designed for controlling water-heater loads. Details and prices are given in Bulletin GEA-1669. (See coupon below.)

A *NEW* G-E publication that will be helpful to you is GES-1106, "Revenue in Off-peak Loads Properly Controlled." It also contains information on carrier-current control.

For copies of these bulletins, address the nearest G-E sales office, or General Electric, Dept. 6A-201, Schenectady, N.Y.

GENERAL ELECTRIC

General Electric Company
Dept. 6A-201, Schenectady, N. Y.

Please send me copies of your two new publications, GEA-1669 and GES-1106.

NAME.....

ADDRESS.....

.....

440-54

recent years. He became known to the electrical industry largely through his connection with Boulder, Bonneville and Grand Coulee dams. At the time of his death he was chairman of the Oregon State Planning Commission, authorized by the recent legislative session in that state and appointed by the Governor. He was born in Holland 75 years ago.

▶ ALBERT C. LEHMAN, chairman of the board and founder of the original unit of the Blaw-Knox Company, died, after a long illness, at his home in Pittsburgh, Pa., in his fifty-seventh year. Due to poor health, Mr. Lehman had not been active for nine months. It was in 1906 that he organized the original company —the Blaw Collapsible Steel Centering Company, which developed into the Blaw-Knox Company, which he served first as vice-president and then as president. Last March he was elected chairman of the board and his brother, Irvin Frank Lehman, succeeded him as president. Mr. Lehman held a directorship in many of the Blaw-Knox subsidiaries and was also prominently identified with other industrial enterprises.

▶ DR. LEWIS FUSSELL, professor of electrical engineering at Swarthmore College, died at his home in Swarthmore, Pa., July 15, after a long period of ill health. He was 53 years of age. A specialist in public utility engineering, Dr. Fussell had been associated, during the summers and on a part-time basis, as a consultant with the United Gas Improvement Company, General Electric Company, Westinghouse Electric & Manufacturing Company, Bell Telephone Company and other corporations. He was a member of several engineering societies and was past-president of the Philadelphia section of the American Institute of Electrical Engineers. Dr. Fussell was a frequent contributor to the technical press.

▶ WILLIAM P. MULHOLLAND, builder of the Los Angeles-Owens River aqueduct and nationally known hydraulic engineer, died at his Los Angeles, Calif., home July 22, after an extended illness. He was 79 years of age. Mr. Mulholland, who began work as a ditch tender for the Los Angeles City Water Company in 1876, when the population of the city was scarcely more than 10,000, rose to head the municipal water system. He directed the affairs of the municipal department until his resignation in 1928 to retire from active work, except to serve the department in an advisory capacity. His greatest engineering accomplishment was the construction of the Owens River aqueduct, at a cost of $24,500,000, which brings water 250 miles to the city from the Sierra Nevada mountains. Mr. Mulholland also was one of the pioneer backers of the Boulder Dam project and did much of the pre-

liminary work in connection with the $225,000,000 Colorado River aqueduct project of the Metropolitan Water District of Southern California, now under construction.

▶ HENRY Z. COBB, for the past 28 years development engineer for the United States Rubber Company at Providence, R. I., died in the Homeopathic Hospital in that city on July 20 at the age of 68.

▶ GUY H. BILLINGS, assistant general manager and purchasing agent of the Four Wheel Drive Auto Company, Clintonville, Wis., died recently, in his forty-sixth year. He had been identified with the Four Wheel Drive Company since 1913.

▶ HENRY W. TIDEMAN, formerly vice-president of the Signal Electric Manufacturing Company of Menominee, Mich., in charge of engineering, died June 1 in Menominee, Mich., at the age of 71 years. Mr. Tideman retired about eighteen months ago because of ill health.

▶ P. LLOYD LEWIS, sales manager for the fan department of the Wagner Electric Company for the past five years, died June 9, of heart disease, at his home in Ferguson, Mo., after an illness of three months. Mr. Lewis was born in Oregon, Mo., 59 years ago and had been connected with the Wagner Electric Company for 23 years.

▶ J. CHARLES STROTT, connected with the electrical engineering department of the Consolidated Gas, Electric Light & Power Company of Baltimore for a number of years, died at his home in that city June 15. Mr. Strott was chairman of the Baltimore section, American Society of Mechanical Engineers. During his career with the Consolidated Mr. Strott occupied several positions in the electrical engineering department. He became connected with the company in 1922 and for about a year before his death was a statistician in the office of the president of the company.

▶ OTTO W. WALTER, assistant professor of electrical engineering at City College, New York, was killed in an automobile crash that occurred July 7. At the time of his death he was 42 years old. Professor Walter was educated at the University of Oklahoma, where he received his A.B. in 1920, his B.S. in electrical engineering in 1921 and an E.E. degree in 1926. He received a degree of master of science in electrical engineering from Massachusetts Institute of Technology in 1927. During the war Professor Walter was engaged in research work in ballistics for the Ordnance Department at the DuPont experimental station at Bloomington, Del.

AMCRECO POLES

Help Lower Operating Costs

Why AmCreCo Poles Have Maximum Quality

1. Select southern yellow pine.
2. Incipient decay avoided.
3. Framing before treatment.
4. Preservative of known value.
5. Adequate single treatment.
6. Treatment accurately timed to proper seasoning.
7. Full length pressure treated.
8. Unequalled facilities and personnel of the leading producer.

ECONOMIES that will hold down operating costs, can no longer be obtained by any single measure. They are only to be found by watching every possible saving in every department.

AmCreCo poles offer a real opportunity to make substantial contributions to this campaign for economy. The low annual cost of full length pressure creosoted poles represents a saving every year for decades to come.

This result is assured in AmCreCo poles by the quality features listed here and these features are backed by an organization that has maintained its position of leadership in the wood preserving industry for more than 30 years.

AmCreCo economy meets today's conditions and will be welcomed by the next generation.

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COLONIAL CREOSOTING COMPANY INCORPORATED
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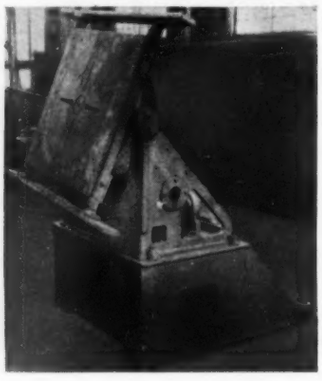
GEORGIA CREOSOTING COMPANY INCORPORATED
LOUISVILLE — KENTUCKY

NEW EQUIPMENT

Welding Manipulator

Positioning of all welding work by means of this manipulator insures fillet welds of correct radius and permits savings in welding time of from 25 to 40 per cent to be



Capacity 5 to 7 tons, depending on center of gravity of work. **United Engineering & Foundry Company**, Pittsburgh, Pa.

realized, it is declared. This equipment is portable and consists of a faceplate which can be tilted to any desired angle by means of a motor-driven gear arrangement.

•

Renewable Fuse Plug

This plug fuse, which uses mercury as the fusible current carrier, can be renewed after blowing by removing it from the socket

Range of amperages available; "Pyrex" glass top, porcelain base. **Central Vacuum Products Co.**, Newark, N. J.

and tapping it point down several times to restore the mercury column. Endless life is claimed for the fuse.

•

Wood Preservation Treatment

Available in three grades—for general use, high moisture conditions and to combat termites. **Osmose Corporation of America**, Buffalo.

Principles of sap displacement and pressure tank treatment are incorporated in this new process. An aqueous paste, consisting of (1) a preservative agent, (2) a protective agent, (3) a paste-forming colloidal substance and (4) water, is applied to the pole at the ground line and penetrates by osmosis and capillary action. A 24-in. bandage of tar-impregnated jute is applied to the pole after application of the paste. Penetration of the preservative is at the rate of 1 in. for spruce and 1.3 in. for pine in 24 days, with respective ultimates of 2.2 and 2.9 in. in seven to eight months.

•

Rural Line Transformer

This transformer, for use on rural distribution systems, is self-eliminating from the line in case of trouble, is provided with a cover type primary bushing, horn-gap

Type R.D.; single phase. **R. D. Uptegraff Manufacturing Co.**, Pittsburgh, Pa.

lightning protection and an internal fuse which protects the isolated line from permanent ground. A grounding stud for primary and secondary grounded neutrals and taps for line-drop compensation are provided.

•

Floor Model Blueprinter

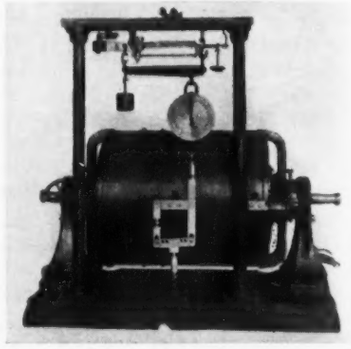
This floor model blueprinter is equipped with washing and fixing trays and drying boards which slide into the base of the machine when not in use. Light for the printing is provided from an incandescent

Model 200; floor space required 28x30 in.; operates on 110 volts a.c. or d.c. **Milligan & Wright Co.**, Cleveland, Ohio.

lamp and is said to produce sharp prints on ¾ to 1½ minutes exposure. A time switch cuts off the lamp current at the end of the selected exposure period. Makes one 18x24 in. print or several smaller ones at one time.

High-Speed Dynamometers

Increased maximum speeds which run as high as 6,000 r.p.m. are now attained in these electric dynamometers as a result of



Capacities from 200 to 300 hp., with maximum speeds of 4,000 to 6,000 r.p.m.; beam-and-dial or automatic scales available. **General Electric Company**, Schenectady, N. Y.

recent developments made in the bearings, lubricating systems and electrical design of d.c. machines.

•

Spring Fuse Links

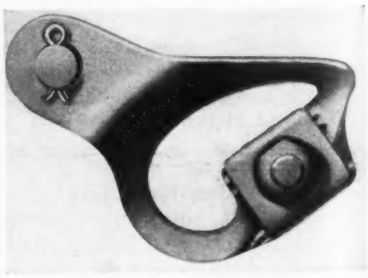
"Unifit" links now available up to 60 amp. **Line Material Co.**, South Milwaukee, Wis.

For fuse cutouts of the straight expulsion design, additional sizes of "Unifit" spring fuse links are now available. These links are said to assure faster and more dependable performance under small overloads.

•

Small Universal Strain Clamp

Exactly similar to the larger clamps, this "baby universal clamp" is applicable to conductor sizes used in rural lines. The



Takes No. 6 to No. 2 solid or stranded wire. **Ohio Brass Co.**, Mansfield, Ohio.

primary snub, in combination with a modified "V" wire groove and positive clamping member, makes the device easy to install and positive in action.

•

Two New Network Cables

General Electric Co., Schenectady, N. Y.

Leaded-type cable has a layer of "Glyptal"-treated cloth covering the conductor and two layers of asbestos over the cloth. Both

cloth and asbestos are treated with "Pyranol" and the whole is inclosed in a lead sheath.

Non-metallic cable for 600-volt service features Glyptal compound sheath and rubber compound insulation which is highly moisture resistant. This cable is suitable for use in oily or alkaline locations where protection from abrasion is not necessary.

•

Horizontal, Edgewise Pyrometer

Rugged construction, perfect damping, accuracy and ease of adjustment are featured in this horizontal, edgewise pyrometer. Temperature readings at a number of zone

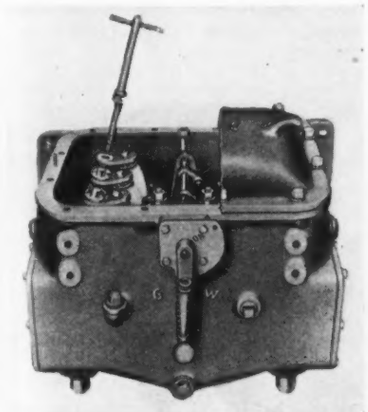
Available with selector switch for 8, 17, 18 or 25 zone points; dimensions 7¼x10¼x7 in. **Illinois Testing Laboratories,** Chicago, Ill.

points are permitted through use of a multipoint selector switch. A manually operated cold-end adjustment is provided. Special design of the gasket structure excludes moisture, dust and fumes from the instrument.

•

Oil and Air Break Switch

Cable conductor terminal contacts in this combination oil and air break switch are totally inclosed in porcelain. Plug disconnects on each side can be pulled out to isolate the oil switch unit from the cable, providing safety for workmen. Interchangeable entrances for single- or multiple-conductor cable are furnished.



Type "KL"; 7,500 volts, 300 amp. **G&W Electric Specialty Co.,** Chicago.

Interference Analyzer

Prompt location and elimination of all types of radio interference are said to be possible with this analyzer for use by public utility trouble shooters and radio service

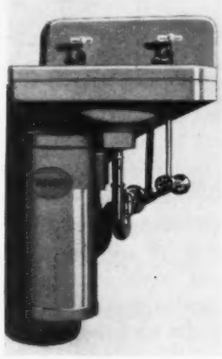
In Bakelite case 4½x7x10 in. **Sprague Products Co.,** North Adams, Mass.

men. Connected into the circuit of the appliance or equipment causing trouble, the analyzer indicates what condensers or chokes are needed to eliminate the radio interference.

•

Small Electric Water Heaters

Designed for small users of hot water such as service stations, small barber shops and beauty parlors and offices, these compact water heaters can be installed directly beneath the lavatory at the point of use. Equipped with an automatic switch, thermostat and temperature control adjustment, these heaters provide a constant supply of hot water at a uniform temperature.

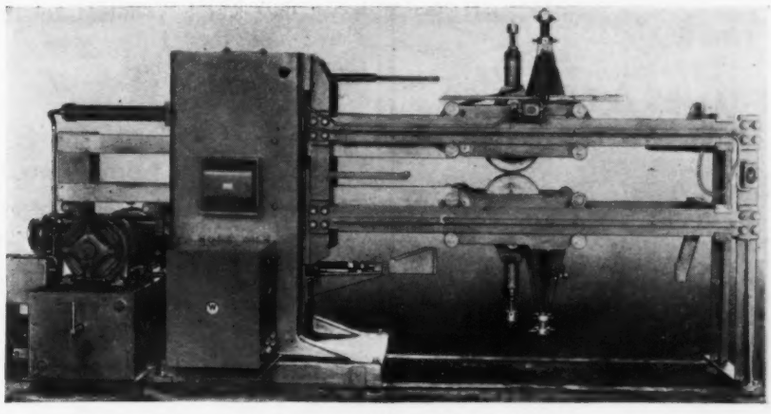


Capacities 1, 2½, 5, 10 to 80 gal. **Lectrolite Corporation,** Defiance, Ohio.

•

Seam Welder for Wide Sheets

Extremely wide sheets of metal can be welded with ease on this machine which employs two traveling rolls to provide contact above and below the seam to be welded. The entire head, consisting of transformer secondary and welding rolls, travels the length of the seam propelled by an oil gear. By making the traveling rolls part of the secondary, the problem of connecting them to the transformer was overcome.



Thomson-Gibb Electric Welding Co., Lynn, Mass.

ENGINEERING DATA FROM MANUFACTURERS

Bulletins and catalogs now available to engineers by manufacturers and associations

Operation of the Dubl-Response temperature control systems is fully described in bulletin 37R announced by the Taylor Instrument Company, Rochester, N. Y. Schematic diagrams are used to illustrate the principle of operation, while temperature control charts show results obtained.

Addressed to skeptical engineers, a recent publication of the Rockbestos Products Corporation, New Haven Conn., presents the engineering features, characteristics and advantages of its asbestos-covered cable.

Pocket Manual of Megger Practice is J. G. Biddle Company's new illustrated 128-page booklet on apparatus maintenance through insulation resistance measurement. It tells why, how and where to use the Megger and how to interpret the readings. Ground resistance is included. Price, 25 cents.

Lighting layouts for the night-time illumination of athletic fields are assembled in a series of data sheets available from the Benjamin Electric Manufacturing Company, Des Plaines, Ill. This series of sheets is designated as No. BM:21.

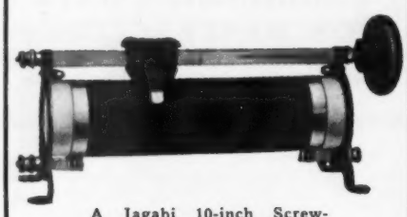
Modern electric motor trucks for delivery purposes are illustrated and their features listed in a 26-page booklet of the Electric Storage Battery Company, Philadelphia. Tabulated data on battery capacities is included.

Rules and Regulations of the Department of Smoke Regulation, Hudson County, Jersey City, N. J., may be obtained by writing the department and enclosing 3 cents postage.

"Simplex Jacks" for railroad, utility and industrial applications are listed in a miniature 40-page catalogue, form No. 235. Applications of these jacks (including cable reel and pole forms) to different jobs are illustrated and their capacities and dimensions given.

Advantages, fundamental principles and applications of combustion control equipment to powdered coal and stoker-fed furnaces are discussed in bulletin 102 of the Bailey Meter Company, Cleveland. Typical installations are described with the aid of pictures and plant layouts.

"JAGABI" RHEOSTATS



A Jagabi 10-inch Screw-Drive Rheostat.

FOR more than 20 years Jagabi Rheostats have been selected by engineers and laboratory workers as convenient and satisfactory devices for regulating current in electrical circuits where fine adjustment is needed with perfect control over a wide range.

Extensive use of Jagabi Rheostats in meter-testing and standardization laboratories, and in industrial research and educational work has made possible the development of these devices to a high state of mechanical perfection, including a number of important improvements in design and construction that have been incorporated during recent years.

Seventy-six standardized ratings of Jagabi Rheostats are regularly carried in stock, and a number of special types—such as Screw-Drive, Double, Non-Inductive, Switchboard, Metal-Protected and Compression Carbon Rheostats—also are available.

If interested, please write for descriptive Catalog 1370-W.

JAMES G. BIDDLE CO.

ELECTRICAL INSTRUMENTS

1211-13 ARCH STREET PHILADELPHIA, PA.

Other Biddle Specialties:

- "Megger" Insulation Testing Instruments
- "Megger" Ground Testers
- "Megger" Capacity Meter
- "Ducter" Low Resistance Testing Sets
- "Dionic" Water Tester
- "Frahm" Vibrating-Reed Tachometers
- "Frahm" Vibrating-Reed Frequency Meters
- "Jagabi" Speed-Measuring Instruments

Are We Solving the "Power Problem"

[*Continued from page 39*]

opens a sackful of new electric toasters and waffle irons fresh from the government power supply warehouses, flashes his official badge, delicately fingers a blackjack in his pocket and, when the householder appears bored with his sales talk, growls, "So you won't buy, eh?" and promptly cracks down.

All this, of course, is highly imaginary. Government men operating the power and light business, or indeed any other business, may exhibit neither the arrogance, the financial irresponsibility, nor the casualness of many bureaucrats on the public payroll. Their attitude toward the customers may in no respect resemble the appropriate attitude of G-men toward suspicious characters. Nothing can be said about that with certainty as yet.

But of the present power people this can be said with certainty—that they regard their public service as a public responsibility, that they firmly believe the people of this country would be better off using 21,000,000 waffle irons instead of only 3,000,000, that they are equipped to tell them this about vacuum cleaners, refrigerators and radios, too, and to consummate the sales, spreading electrical housekeeping as well as electrical manufacturing far and wide, reducing costs, increasing employment, keeping on ahead. That is the way the power people have built up the power business; that is why they are successful, and that is the basis of their plans for the future.

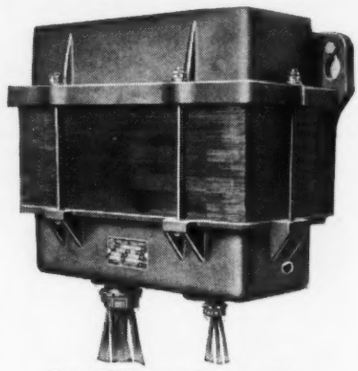
This may not be the right solution to the power problem from the viewpoint of the New Dealer or the G-man in the power business. It may appear ridiculously old-fashioned to them. But the power people of today are probably old-fashioned fellows. They wish the G-men would do something about the national debt problem and leave the power problem to them. They think they know what to do about it, and they think the customers will like it.

•

Utility Unit Air Conditioned

S. S. Fretz, Jr., Inc., distributor of General Electric air conditioning equipment in the Philadelphia area, has just been awarded the contract for installing complete year-round air conditioning equipment in the Camden commercial building of the Public Service Electric & Gas Company, Federal Street, Camden, N. J.

AmerTran Air-Cooled Transformers



Type CFT three-phase, outdoor-type, air-cooled transformer

for every industrial application

- **Air-Cooled—no oil or fireproof vault**
- **Conduit Fittings—easy to install**
- **Single-Phase or Three-Phase types**

AmerTran Air-Cooled Transformers and Auto Transformers reduce operating costs . . . they may be used on single or three phase circuits for boosting voltage (208 V. to 230 V.) or for supplying 115/230 volts for lighting or power from 230-, 460-, 575-, or 2,300-volt power circuits so that advantage may be taken of the lower power rates. Other standard types are furnished for phase-changing, and operating low-voltage equipment.

Type CF units illustrated are of weatherproof construction and are equipped with conduit fittings. They are Underwriters' Laboratories inspected and meet A.I.E.E. standards. Send for price sheet No. 1116 listing sizes from 50 Va. to 150 Kva.

Type CF single-phase, outdoor-type, air-cooled transformer

AMERICAN TRANSFORMER CO.
178 Emmet St., Newark, N. J.

Recent Rate Changes

Arkansas State Department of Public Utilities was informed by a committee representing the larger utilities of Arkansas at a recent conference that rapid progress was being made in formulating a basic plan for objective rates which will provide substantial reductions in power rates throughout the state. The committee representing the utilities was named June 26 at a hearing which followed issuance of the order by the state commission directing introduction of objective rates. The commission held at this meeting that rates in Arkansas are excessively high in comparison with rates in other states.

•

Gulf States Utilities Company has been ordered by the Louisiana Public Service Commission to reduce its electric rates $40,000 annually. The company serves the city of Lake Charles and about 25 smaller localities in southwest Louisiana. The reduction is the third to be made in the company's schedules since November 1, 1934.

•

Southwestern Gas & Electric Company has been directed by the Arkansas Department of Public Utilities to file by October 1 an inventory and appraisal of all its property in certain cities served by the utility in Sebastian County. A petition was filed with the department by eleven coal operators, charging that the company required them to pay excessive rates. P. A. Lasley, chairman of the commission, said that a preliminary investigation showed that residential consumers were served by the same lines that served coal mines and that a general investigation of the company's business in that section would be necessary before the department could determine what the rates should be.

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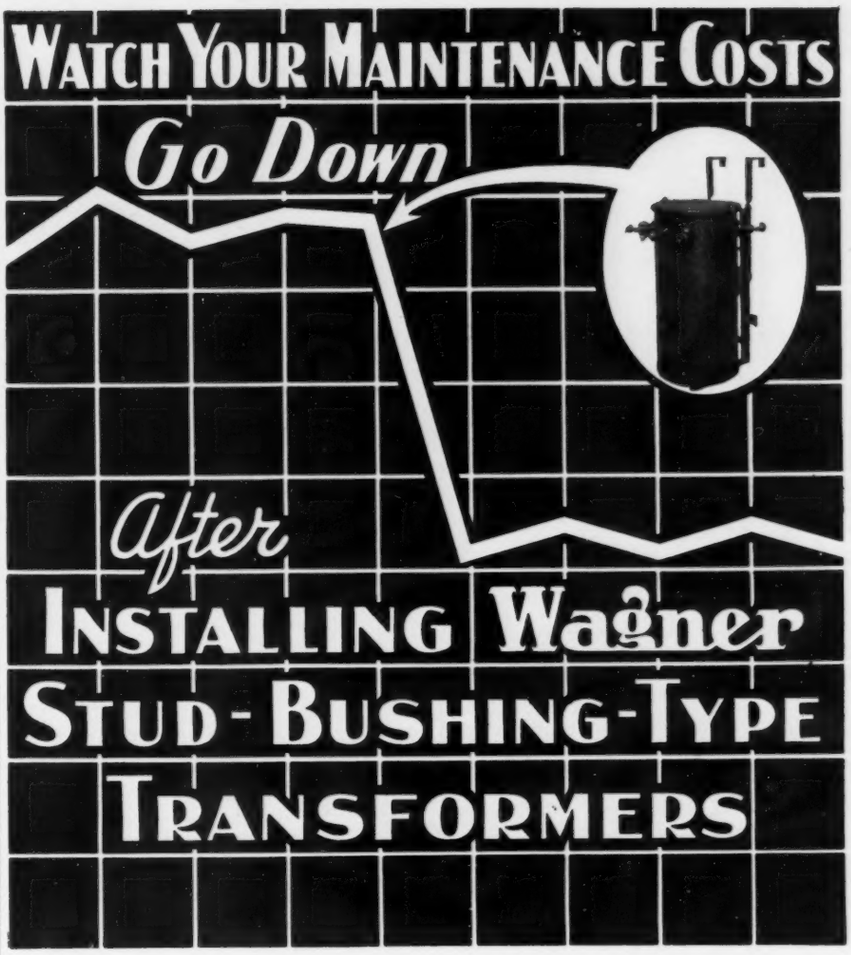
Home Gas & Electric Company of Greeley, Colo., demurred from the ruling of the Public Utilities Commission that it reduce its electric rate approximately 12 per cent and carried the case to court. Judge Frank McDonough upheld the commission, but stated that there was doubt in his mind whether or not 6 per cent profit was sufficient. The company claimed a rate making valuation of $1,250,000, but the commission set the value at $836,075.

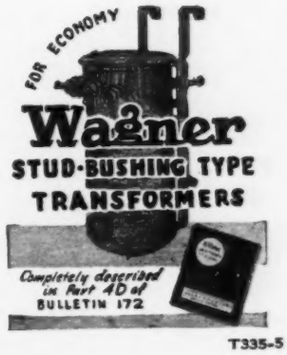
•

Salem Electric Light Company's rate hearing before the Massachusetts Department of Public Utilities was continued until some time in September. The case was opened on petition of the Salem Citizens' Protective League for a reduction in rates. In the meantime the interested parties, including the Governor's utility committee, will confer in an effort to bring about a reduction in rates.



Wagner stud-bushing-type transformers reduce maintenance cost, because:

1. No replacement of leads is necessary when the transformers are removed from service—or are damaged in handling—or due to deterioration in service.
2. Porcelain bushings are designed with definite flashover values that will remain constant.
3. No trouble due to syphoning of oil.
4. Bushings can be easily and quickly removed without lowering transformer from poles or platform.
5. No soldering is necessary for connecting the transformer to the line.
6. Transformers are shipped filled with oil—prevents absorption of moisture by the coils while in transit.



T335-5

Wagner Electric Corporation

6400 Plymouth Avenue, Saint Louis, U.S.A.

TRANSFORMERS MOTORS FANS BRAKES

Steam Valve Control Room in a Large Western Power Station

ROCKBESTOS

Requires no

AIR-CONDITIONING

Engineers usually shake their heads dubiously when planning wiring layouts in places like this because heat is well-known to be "bad medicine" for wire — that is, all except Rockbestos wire.

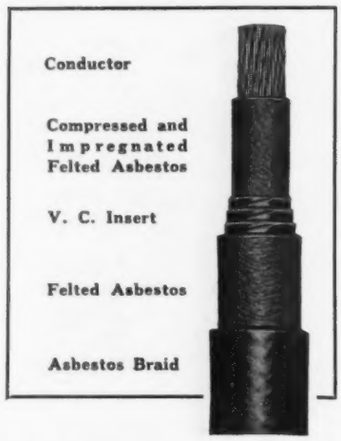
With Rockbestos you don't need to worry over the fact that temperatures in and around the ducts may run around 200° F. For the principal ingredient of Rockbestos insulation — asbestos — was borne of terrific pressure and volcanic heat that makes 200° F. seem like a cool summer zephyr by comparison!

Rockbestos A.V.C. insulation — felted, impregnated and compressed layers of asbestos with an embedded insert of high dielectric of varnished cambric — can't become hard or brittle and can't swell or flow under heat. Hundreds of installations in steel mills, boiler houses and kiln rooms testify to this.

Never mind the temperatures. Place conduits where you want them, no matter if that happens to be alongside a steam header, furnace, soaking pit or boiler. Using Rockbestos wire allows you to do this.

Our catalog-handbook tells how and where to use Rockbestos wires. Send for it. Rockbestos Products Corporation, New Haven, Conn.

Typical A.V.C. Insulation Construction



ROCKBESTOS

—the wire with permanent insulation

80,000,000 Electric Customers

Electric service is used by 80,000,000 customers in the various countries of the earth, the United States leading with nearly 25,000,000.

Electrical Foreign Trade Notes for April 5, published by the Department of Commerce, announces the data here given, excepting those for the United States, which have been added from a report of the Edison Electric Institute. Figures are missing for some countries, the most important being Soviet Russia, Spain, Mexico and Chile.

As given, the continental totals are: Europe, 38,505,732; North America, 26,544,933; South America, 1,780,212; Asia, 11,888,154; Oceania, 1,160,435; Africa, 246,309; U. S. Possessions, 170,016.

World Electric Power Consumers by Countries

	Year	Total All Classes Combined	Domestic
Europe			
Austria	1927	.....	500,843
Belgium	1930	1,453,000	.....
Czechoslovakia	1928	.....	1,607,240
Denmark	31/32	948,700	816,000
Finland	1933	366,660	.....
France	1931	7,620,253	.....
Germany	1929	10,182,272	.....
Hungary	1927	2,225,515	.....
Irish Free State	1933	81,675	.....
Italy	1932	5,231,366	.....
Latvia	1933	124,256	.....
Lithuania	1931	.....	44,750*
Poland and Danzig	1929	686,216	.....
Portugal	1930	160,528	.....
Sweden	1930	1,090,500*	.....
Switzerland	1932	981,958*	.....
United Kingdom	1934	5,200,000*	.....
North America			
Canada	1931	1,632,792	.....
United States	1934	24,808,537	20,484,232
British Honduras	1930	950	.....
Costa Rica	1930	17,548	15,183
Guatemala	1930	24,151	20,413
Honduras	1930	5,748	4,900
Salvador	1930	17,325	16,400
Newfoundland & Labrador	1930	16,475	15,000
Bermudas	1930	6,000	.....
Barbados	1930	4,333	.....
Jamaica	1930	7,080	4,311
Haiti, Republic of	1930	3,994	3,667
South America			
Argentina	1932	997,637	.....
Brazil	1932	725,000	.....
Colombia	1931	25,171	21,738
Ecuador	1934	28,268	22,897
British Guiana	.....	4,136	4,050
Asia			
British India	1932	217,507	.....
Netherland East Indies	1931	247,884	.....
Japan	1929	11,124,000	10,847,000
Palestine	1933	21,934	.....
Persia	.....	22,000*	20,000
Philippine Islands	1930	116,000	88,000
Siam	1930	22,161	21,583
Turkey	1932	116,668	.....
Oceania			
Australia	1928	876,200	.....
New Zealand	1930	284,235	.....
Africa			
British East Africa	1930	4,925	.....
Union of South Africa	31/32	200,489	174,317
Gold Coast	.....	3,030	2,950
Nigeria	1930	3,200	.....
Algeria and Tunisia	1928	31,665	.....
Other Portuguese Africa	.....	3,000*	.....
U. S. Possessions			
Hawaii	1932	128,016	.....
Puerto Rico	1930	42,000	.....

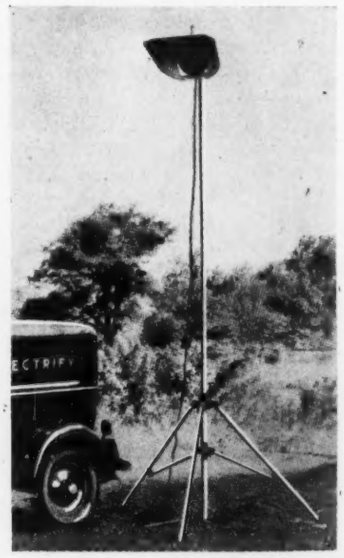
*Estimated.

You'll Sell More Lighting When You DEMONSTRATE Its Effectiveness

The explaining a salesman does —the enthusiasm he puts into his talk—the pictures of fixtures he shows—are good, do help sell more and better lighting.

But to make quick sales, *demonstrate —show your prospect* what better lighting *will do for him.*

Use the *Pemco Portable Demonstrating Tripod.* Put as many of them up as are needed to do a correct lighting job. Turn on the current and then show Mr. Prospect where to sign on the dotted line. You'll be astonished how well it works—how it simplifies the selling job.



PEMCO PORTABLE DEMONSTRATING TRIPOD

Collapsible. Simple. Sturdy. Made of light steel tubing for maximum strength and light weight. Easy to set up. Carried in the salesman's car. Write for details and price.

PHILADELPHIA ELECTRICAL & MANUFACTURING CO.

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